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NOVEMBER 1982

INFOSYSTEMS

THE MAGAZINE FOR INFORMATION SYSTEMS MANAGEMENT

The Readers Speak Out: The State of MIS

The Mainframe's Future Voice and Data Networks

Project Management Software

RECOVERING FROM A DISASTER

Exclusive Interview Adam Osborne

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Features

Management
26 Disaster Recovery

Inforum
36 The Information Center

Interview: Adam Osborne
40 The Humpty Dumpty Game

Communications
46 Bringing Voice into the Long-Distance Data Network

Communications
50 Building Computer Networks

All Things Considered
54 Survey Results: MIS Is Angry & Bitter

Manufacturing Info
62 The Rise & Fall of Just-in-Time

For the Sake of Security
64 Risk Analysis: Not a Crystal Ball

Project Management
66 The Architectural Plan

Mainframes
74 Room at the Top

Snyders on Software
82 In Praise of 'Lumping' Software

Technology Info
84 The 'Sleeping Giant' Saga Continues

Power Protection
88 Fighting Flash 'n' Flicker

Software
100 Videotaping Your Documentation

Micro Business
108 Keepin' 'em Down on the Farm

Systems Architecture
112 A Total Approach

Management
118 A Cap on Hospital Spending

Data Retrieval
120 Taking the Tedium out of Information Gathering

Management Information Systems
122 Putting It Together

Automatic Scanning
128 Generating Information

Spotlight
130 The Demise of 'Telephone Tag'

Departments

6 Reader Feedback
8 Editor's Perspective
10 Arnie
14 Inside Info
22 IN Brief
78 Info Software
134 Products/Services Info
141 New Micro Products
143 Plan Ahead
143 Bookcase
144 Ad Index
145 Literature

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Ergonomics

Key is to balance computer response time with user performance

In the old days when typewriters from Harrods (in London) cost six and a half pounds, newspapers carried advertisements urging shorthand typists to purchase shoulder braces to cure their work-related ills.

Although technology has certainly progressed, these types of concerns haven't, according to Brian Shackel, founder and director of the Human Sciences & Advance Technology (HUSAT) research group at Loughborough University in England. As efforts are taken to balance computer response time and user performance, this will change, he said.

To this end, input and output devices should be selected that are comfortable for the user and in accordance with other workplace standards, Shackel pointed out at the World Conference on Ergonomics in Computer Systems held in Chicago.

Shackel explained that workplace design is often carried out with a "take it or leave it approach." There are problems with this thinking, he said. He cited discretionary users who can choose whether or not they want to be a part of the technology, and then there are those who have to rely on the technology if they want to keep their jobs. He said it's important to remember that users vary in their attitudes, physical strength, motivation and training.

"If you see DYI (do-it-yourself) ergonomics, you can guess that the design is inadequate," Shackel noted. An example of this would be if an employee taped a handwritten sign on a facsimile machine that said, "Slide your document through quickly."

Usage is dependent on a complex circle of information decision loops, according to Shackel. For instance, human input is basically multichanneled, flexible but slow, and dynamic in range. Computer output, on the other hand, is primarily visual, fast and limited in speech.

For effective design, human characteristics need to be evaluated, Shackel said. Silent reading typically averages 300 words per minute (wpm) whereas spontaneous speaking averages 150 wpm. A person speaking much faster would lose his audience.

In other human communication modes, the average handwriting speed is estimated at between 24 and 30 wpm. Shackel sees this becoming obsolete. Skilled typists average 100 to 150 wpm and can punch a 10-button phone at between 70 and 90 wpm.

Characteristics such as these affect the way a keyboard should be designed, Shackel said. There has been much research on whether letters and numbers should conform to telephone, calculator or typewriter layout or to some other two-row type of format.

Although "qwerty" is the de facto standard, Shackel conceded that it puts a higher load on the left hand. A European-developed keyboard has an estimated five percent improvement rate over "qwerty," he said, but long-term fatigue is not measured.

Shackel recommends devising an international standard that would complement all languages. Research also has probed designing keyboards around the human hand, in a split-level sort of mode.

Other related input devices include the mouse, light pens, touch screens and digital tablets. But Shackel thinks it would be more disruptive for a touch typist to go to a mouse, for example, than to a cursor or text edit keys. Optical character readers (OCR) and voice recognition also are becoming popular.

The most commonly used output devices are printers and CRTs. Alternative technologies are available, however, including synthesized speech, electroluminescence panels and liquid crystal displays.

With printers, ergonomic considerations include size and style of type font, noise and user controls. With CRTs, screen size, distance from user, tilt and swivel capacities, glare reduction, character brightness and user controls should be taken into account.

Shackel added that most people would prefer to read a printout of something they wrote on a terminal. It takes 25 to 30 percent longer to do text editing on screen than on paper, he said, noting that people produce 10 percent more errors with text editing. Shackel would also like a format designed to enable users to see a visual overview of what's in a data base, rather than bits and pieces compressed into one window.

The solution, according to Shackel, is to develop recommendations in all areas. With all the talk about "user-friendly" workstations, he said, there's still a growing number of people who concede, 'Well, I'm not computer-friendly.' "

—WJC

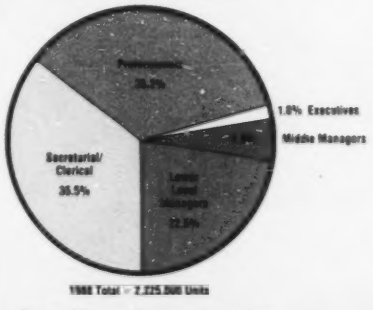
Trends

Clericals, professionals vie for market

Secretarial and clerical workers are expected to continue to use the greatest number of workstations over the next five years, although professional workers will penetrate the workstation market. This is one of the conclusions reached in a study conducted by Advanced Resources Development (ARD), Medfield, MA.

Workstation Shipments by Occupational Category 1988

(Percent of Units)



Source: Advanced Resources Development

Shipments of workstations to the secretarial/clerical sector are predicted to increase from 200,000 in 1983 to 790,000 in 1988. Shipments for use by professional workers also will increase from 114,000 in 1983 to 785,000 in 1988, the study notes.

Although automation has been slower in this sector than other white-collar sectors, the report expects to see significant future growth. This might be affected by the increasing popularity of the personal computer and the focus on managerial sector improvements in productivity, ARD says.

Despite the expected growth, the study points out that the secretarial/clerical market share will dip from 47 percent in 1983 to 36 percent in 1988. The professional workers' market share, on the other hand, will jump from 27 percent in 1983 to 35 percent in 1988.

The managerial sector, consisting of executives, middle managers and lower level managers, will account for 650,000 workstation shipments in 1988, up from 116,000 in 1983.

—KAG

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January 1985

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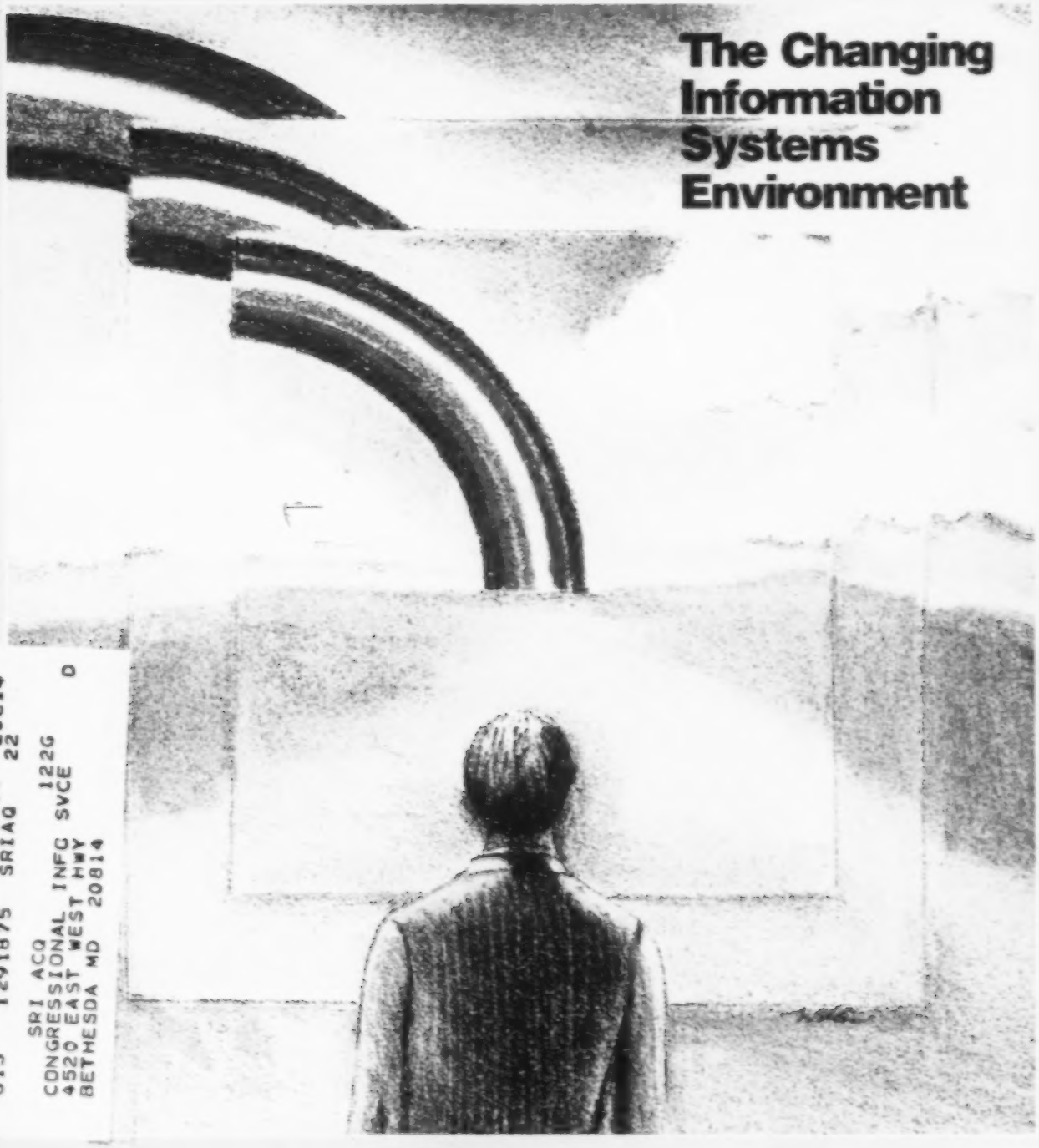
What's Ahead in Software • How to Rehabilitate a DP Shop

The Information Center: A Class of Service • Software Generators

You Don't Need a DBMS to 'Do Data Base'



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30

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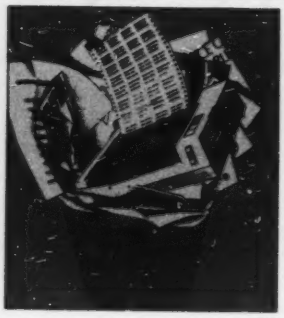

88

58

FEATURES

30
The Changing Environment of Information Systems
Work concepts are reaching beyond the conventional boundaries of the workplace.

36
***Inforum:* Priority Pursuits**

40
'One Layer at a Time'
Several forces—including end users, personal computers and IBM—are shaping the future of the software industry.

48
***Micro Business:* Policeman's Interest in PC Productivity Points to 'Retirement' Career**

56
***For the Sake of Security:* What you 'Need' to Know**

58
Managing Information Systems at the Multinational
Managers have learned the difference between influencing and imposing.

64
***Snyders on Software:* Bridging the Generator Gap**

72
A Class of Service
Superior Oil's information center provides an effective vehicle for "front-ending" the MIS department.

78
In Defense of the Maintenance Programmer
Considered one of the most underrated DP jobs, maintenance deserves more attention than it often gets.

80
The Strategic Approach
If information systems planning is thought of as a beehive, the common focus is on success.

86
***Manufacturing Info:* How Do You Compare to 1,000 Other Companies?**

88
How to Rehabilitate a DP Shop
To clean up data processing departments, some guidelines must be followed.

94
You Don't Need a DBMS to 'Do Data Base'
With the right tools and the right philosophy, an organization can be better poised for the relational world.

100
***Spotlight:* The Reliability Quotient**

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INFOMART, Dallas

INSIDE INFO

12 SNA primary glue, not X.25, to make all products work together
15 Cry of 'user resistance' is red herring to deflect attention
16 Fighting for 'discretionary dollars' to overcome complacency
18 Dealing with users who don't know how to say what they want
20 The Netherlands is a logical place for US computer companies

APPLICATION REPORTS

52 The Art of Filing
76 Compact but Versatile
99 Down to a Science
102 A Farewell Bid

DEPARTMENTS

6 Feedback
8 Editor's Perspective
22 In Brief
26 Arnie
66 Info Software
106 Products/Services Info
114 New Micro Products
118 Literature
120 Plan Ahead
120 Bookcase
122 Ad Index

How Do You Compare to 1,000 Other Companies?

By Darryl Landvater
President
Oliver Wight Video Productions Inc.
Newbury, NH

Where does your company stand in relation to over 1,000 materials requirements planning (MRP) users? Near the top? In the middle? I hope not at the bottom.

Competition is increasing both abroad and within the US, and it makes sense to know where you stand. History shows there is no company so large or so successful that it cannot be toppled by more effective competitors.

We conducted an extensive survey on MRP and manufacturing resources planning (MRP II). The response from more than 1,800 companies makes this one of the largest surveys of its type. We've collected the data, but only you can make the assessment of where your company stands.

Q. Are you doing anything with MRP or MRP II?
A. Over 60 percent or 1,123 of the companies which responded were using either MRP or MRP II. This is somewhat misleading since we directed our survey to companies that we suspected would be using MRP or MRP II. Yet, the fact that over 1,000 companies are actively using MRP does indicate that MRP is not a fad or a gimmick. One company in the survey has been using MRP for over 20 years, others more than 10. MRP is an accepted and normal part of running a manufacturing business for these people.

Q. What effect has MRP/MRP II had on your company?
A. The success rate was astronomical. The data was correlated for all companies using MRP/MRP II and all Class A users. (Class A users are those companies scoring 90 percent or more on a standardized checklist used to evaluate MRP/MRP II performance.)

	Percentage of All MRP Companies	Percentage of Class A Companies
Enormously better	32	80
Somewhat better	53	19
About the same	13	—
Not as good as before	2	1

Q. What have been the measurable benefits of MRP/MRP II?
A. The measurable benefits were significant enough to allow these companies to become more effective competitors. The numbers below are weighted averages for all MRP users and Class A companies.

	Percentage of All MRP Companies	Percentage of Class A Companies
Inventory reduction	17	25
Improved customer service	16	28
Improved productivity	10	16
Reduced purchase costs	7	11

Q. What have been the intangible benefits of MRP/MRP II?
A. While these are hard to translate into dollar benefits, they do affect the ability of a company to compete effectively.

	Percentage of All MRP Companies	Percentage of Class A Companies
Better control of the business	89	99
Better planning/simulation	82	97
Improved market share	36	65
Improved vendor performance	63	94
Better quality of work life	65	88
Eliminates end-of-the-month crunch	58	88
Improved cost control	74	97
Reduced expediting	77	98

Q. What were the costs of implementing MRP/MRP II?
A. The costs were essentially the same regardless of how well or how poorly MRP was working. The cost for all MRP companies was $907,000; Class A companies, $1,181,000; and for Class D companies, $1,002,000 (Class D companies are those scoring below 70 percent on the standardized checklist for evaluating MRP performance). The Class A companies spent more for education. The Class D companies spent more for other unspecified costs.

From this data on costs and measurable benefits, we calculated the return on investment (ROI) for implementing MRP/MRP II. The results qualified MRP/MRP II as a worthwhile project based on nearly any company's investment criteria. In fact, the hard part would be to convince the financial people that the numbers are real. The weighted average for Class A companies was over 200 percent. The weighted average for all MRP companies was 140 percent.

Q. In implementing MRP/MRP II, what did you do?
A. The Class A companies, those with the best operating results, followed the recommendations that have been common knowledge for years. The Class D companies, those with the lowest operating results, did not do as well.

	Percentage of Class A Companies	Percentage of Class D Companies
Top management education	82	50
Formal cost/benefits study	66	36
Full-time project leader	83	49
Proven implementation plan	60	24
MRP consultant	73	44
Key managers educated outside	89	58
Video-assisted education inside	70	55

After looking at where your company stands relative to others, the next step is yours. It's the hardest step, but one that doesn't get any easier with time. You must do something if your company is to become more competitive. (N)

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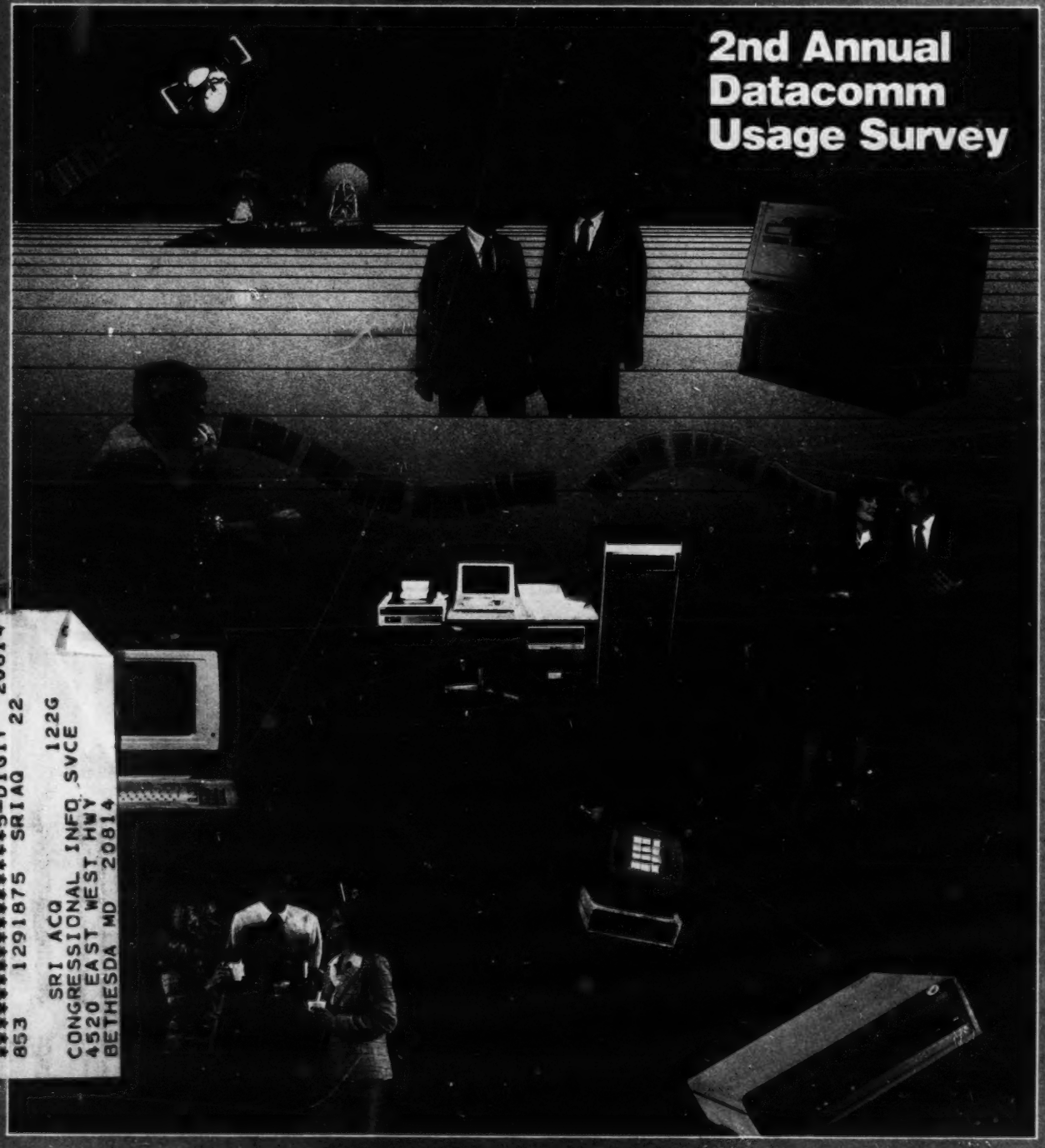
Conversion Software • Why Prototyping Works • Local Area Networks

5th Semiannual Review of Microcomputer Software Packages

Power Protection • MIS User Groups • Selecting Applications Software

2nd Annual Datacomm Usage Survey



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30

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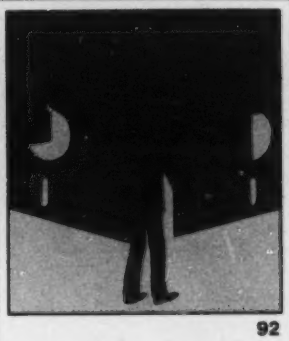

92

FEATURES

30
2nd Annual Datacomm Usage Survey: **MIS/DP Tightens Grip on Systems**

38
The Wake of Divestiture
The breakup of AT&T has caused many to shake their heads in disbelief at vendor bickering and confusing price structures.

42
Inforum:
'Insurmountable Opportunities'

48
Snyders on Software:
The Second Generation

56
Resource Sharing: The Promise of Local Area Networks
Will the corporate masses gain low-cost access as personal computers make mainframe connections?

62
Making the Most of User Groups
An excellent forum is available in which users and vendors can exchange ideas.

72
Conversion: The Problems Go On
What are the alternatives when an operating system no longer meets increased application demands?

76
Manufacturing Info:
Our Self-Inflicted Wounds in Labor Relations

78
The UPS & Downs of Power Protection
With micros processing critical information, power fluctuations can be more than just inconvenient.

84
Technology Info:
Which is the Fairest Display of Them All?

86
Micro Business: **The 'Highest Paid' Programmer**

88
Why Prototyping Works
A crisis at a major corporation proved to be the catalyst for a radically different approach to systems development.

92
Software Selection Made Easy
Involving users and MIS, spelling out needs, and putting requests in writing are among the procedures suggested.

94
Spotlight: **The Security Vow**

100
5th Semiannual Microcomputer Software Review:
Versatility in Software Important to PC Selection

122
The Diebold Report:
Computers are Changing the Way Your Company Competes

INFOSYSTEMS is proud to announce that the international consulting organization, The Diebold Group, will be contributing an article every other month on management and technology. This month in the premier of "The Diebold Report," John Diebold, author of the prophetic book *Automation* and the recently released *Managing Information*, writes about strategic uses of information (see page 122).

INSIDE INFO

10 California Assembly sets about planning for 'information age'
12 Systems address network management, mainframe-to-mainframe
14 'Box canyons' are not the problem for Prime Computer users
16 Bay Area executives use PCs as after-fact tool, to communicate
25 Dallas Infomart opens with Unix

APPLICATION REPORTS

68 Adventures of an MIS Consultant in Saudi Arabia

DEPARTMENTS

6 Feedback
8 Editor's Perspective
28 Arnie
50 Info Software
110 Products/Services Info
119 Literature
120 Plan Ahead
120 Bookcase
121 Ad Index

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2nd Annual Datacomm Usage Survey

MIS/DP Tightens Grip on Systems

Divestiture of AT&T, equipment compatibility, lack of expertise, and multivendor environment are cited as leading problems by managers.

By Chuck Cozette, Associate Editor
and Ray Winkler, Manager, Market Research

If data processing/management information systems (DP/MIS) managers were to have as many heads as they have professional hats to wear, they'd be likely candidates for either a late-night horror movie or Ripley's Believe It or Not.

One such hat, of the 10-gallon variety if scope of responsibility is any measure, encompasses the area of data communications. A recent INFOSYSTEMS' study revealed that almost 80 percent of more than 1,100 DP/MIS managers surveyed have direct responsibility for data communications within their companies. Of the almost 13 percent of the respondents who indicated such responsibilities are handled by a datacomm manager, 71.6 percent said that the individual reports to DP/MIS.

The survey, conducted in January by Hitchcock Research Services of Wheaton, IL, was mailed to 4,000 DP/MIS management-related individuals representing a broad cross-section of industries across the US. Replies were received from 1,160 recipients. This is the second year of the survey sponsored by INFOSYSTEMS.

For the average DP/MIS manager, the responsibility for data communications is a mixed blessing.

On the one hand, this responsibility can mean an expanded corporate role for DP/MIS managers. At least 93 percent of survey respondents indicated the presence of a data communications system within their companies. More than half of the respondents said that moderate to substantial expansion was being planned for.

Where there is an opportunity, however, liability may not be far away. As might be expected, DP/MIS managers are not without ammunition when it comes to citing difficulties in the installation and use of data communications systems.

It would probably come as little surprise to even the casual phone user that post-divestiture AT&T headed the list as a source of problems. Confusion regarding responsibility for particular services ranks as the primary problem, according to the survey, although delays

in line and equipment installation also were mentioned repeatedly.

"Since the breakup of AT&T, it has become very difficult to install even the simplest data communications equipment," commented one respondent. "We are dealing with four or five separate entities and the new divisions are very confused. They (AT&T) are not marketers nor are they aware that they must perform in a competitive arena."

Another respondent summarized what seemed to be a general perception re-

Products and Services

	Presently Use	Plan to Add in Next 12 Months
Terminals	58.6%	41.8%
Modems	59.4%	39.4%
Printers	37.1%	34.8%
Microcomputers	76.1%	39.2%
Communications software	66.8%	36.1%
PBX interface	40.8%	19.5%
Communications processors	46.5%	18.0%
Micro-to-mainframe links	33.7%	55.1%
Multiplexers	37.4%	22.4%
PBX/Data Voice	22.4%	7.9%
Centrex Systems value-added packet switching	41.3%	14.3%
Local area networks	26.6%	33.1%
Diagnostic and test equipment	29.0%	14.4%
Local area network	20.7%	30.6%
Network control system	16.9%	19.9%
Public data	16.6%	9.7%
Public Value-added data	13.6%	12.3%
Base	1,087	771
	100%	100%

Number of Respondents by Job Title

	No. of Respondents	Percent
DP/MIS Operations		
DP/MIS Management	799	68.9%
DP/MIS Supervisory	113	9.7%
DP/MIS Staff	52	4.5%
Sub-Total	964	83.1%
Company Management		
General and Corporate Mgmt.	67	5.8%
Financial Management	54	4.7%
Administrative Services Mgmt.	55	4.7%
All Other	20	1.7%
Sub-Total	196	16.9%
Total Respondents	1,160	100%

Expansion Plans by Present Users (Next 12 Months)

	Local Systems	Metropolitan Area Systems	Long Distance Systems
Base: Presently Have System	1,087 100%	335 100%	612 100%
Will expand moderately	42.1%	42.7%	38.1%
Will expand substantially	11.8%	9.6%	15.4%
Will change or replace present systems	12.5%	11.3%	12.5%
No changes planned	36.2%	36.5%	37.1%

> ***"Sales people do not understand network technology and sometimes don't even understand their own products."***

garding AT&T, "The left hand no longer seems to know what the right hand is doing."

Equipment incompatibility and lack of expertise, both in-house and by service representatives, were other problems consistently cited. One respondent, typifying the feelings of many in DP/MIS, complained, "Performance claims are not demonstrable and compatibility claims are not always true."

When products do not live up to their billing, many managers become frustrated with the lack of technical support from vendors. "Sales people do not understand network technology and sometimes don't even understand their own products, so selection of equipment is difficult. This is especially true when faced with major problems," explained one respondent. "Combine that with a multivendor environment requiring highly interactive communications and the lack of a multivendor communication standard and you have a real mess to deal with."

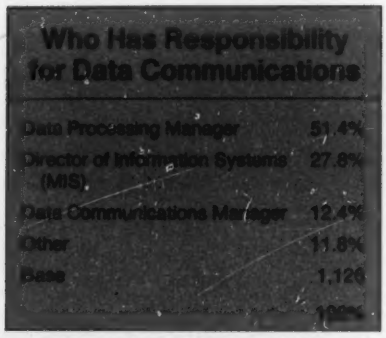
Such difficulties can pose further conflict when the DP/MIS manager responsible for data communications does not have final say in the purchase of equipment and services. The survey indicated that while 96 percent of the respondents were involved to some degree in purchasing decisions, with 56.1 percent responsible for specifying either the type of equipment or supplier, only 35.8 percent had authority to approve the purchase. These figures would suggest that in addition to the challenge of obtaining systems expertise, DP/MIS managers must continue to sharpen their diplomacy skills if they are to get purchases approved by designated executive officers and committees often preoccupied with the infamous "bottom line."

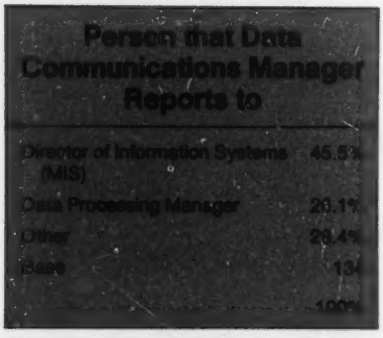
On the other end of the spectrum, many DP/MIS managers are also being held accountable by the end user, who, according to the survey, sometimes has input into the purchasing process. While user clout is usually limited, in at least one instance users had individual budgets with 100 percent authority to accept or refuse purchases. Survey results would seem to indicate, however, that more often than not, DP/MIS managers find themselves caught in the middle; answering to upper management for cost control and accountable to demanding end users for system performance.

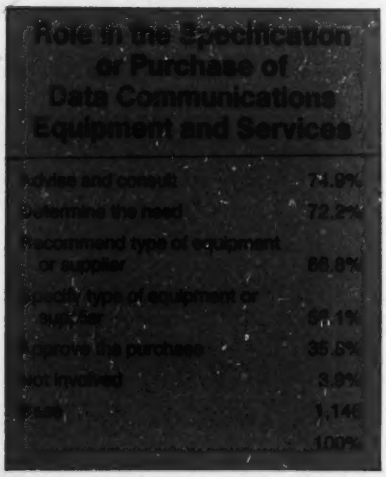
The diversity of the survey's sampling was reflected by a wide variation in datacomm usage. Approximately 94 percent of the respondents said they currently have local systems, up from 74.7 percent last year. Usage of long distance systems remained stable at about 54 percent, as did metropolitan area systems at approximately 30 percent.

Those using datacomm were asked to indicate their plans for expansion in the next year. Of those who said they have local systems, 42.1 percent said they will expand moderately, 11.6 percent plan substantial expansion; and 12.5 percent expect to change or replace their current system. Thirty-six percent plan no changes.

Despite dissatisfaction with AT&T,






Role in the Specification or Purchase of Data Communications Equipment and Services
Advise and consult 74.9%
Determine the need 72.2%
Recommend type of equipment or supplier 66.9%
Specify type of equipment or supplier 64.1%
Approve the purchase 35.8%
Not involved 3.9%
Base 1,146
100%

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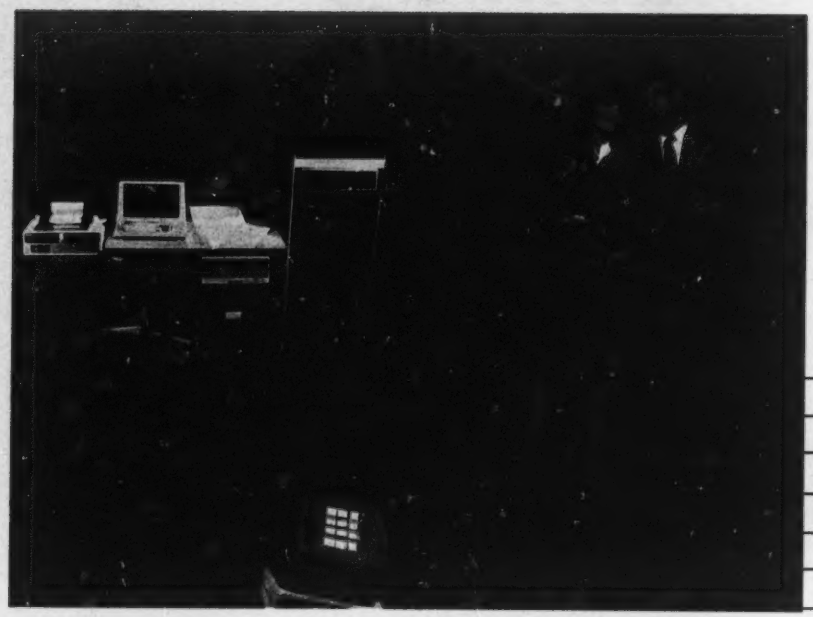

"Since the break-up of AT&T, it has become very difficult to install even the simplest data communications equipment."

managers of datacomm apparently still face a significant need to expand or adapt long distance systems. Of those with long distance systems, 38.1 percent plan to expand moderately; 15.4 percent substantially; and 12.6 percent expect to change or replace current systems. Thirty-seven percent plan no changes.

These predictions for expansion are slightly lower than last year's. While this could represent a mild leveling off of datacomm activity, it more likely signifies a lull in what in some cases has been a frenzy of activity. Companies may either be busy integrating equipment already purchased or taking a respite while awaiting new and improved technology.

In the area of integrated voice/data systems, however, implementation continues to lag significantly behind initial industry projections. While 26.2 percent expect moderate activity, up 11 percent over last year, extensive activity is still planned by fewer than four percent of the respondents. More significantly, the number of companies already having completed voice/data integration remained at only 1.7 percent.

The trend towards distributed processing continues to shape purchasing plans. Micro-to-mainframe links replaced terminals atop the list of products and services respondents plan to add in the next 12 months. While 43.7 percent of those surveyed already have micro-to-mainframe links, an astounding 55 percent plan to add initial or additional uploading and downloading capabilities. Approximately 40 percent of respondents intend to buy terminals, modems and/or microcomputers. Interest in local area networks continues to increase, with almost one third of the respondents planning purchases.

Priorities in purchasing were identical to last year's, as DP/MIS managers reaffirmed their desire to maximize "uptime." Product reliability once again headed the list as the most important purchasing consideration with a 9.26 rating on a 10-point scale. The performance of products according to specifications was a close second with a 9.19 rating, followed by the availability and speed of repair service, reputation for high quality products and system compatibility.

Unfortunately, tunnel-visioned vendors do not always share the DP/MIS manager's priorities. One respondent complained of difficulties in "finding vendors who will tell us exactly what we need. Everyone wants us to learn their business. They don't want to learn what we need and how we need to use their equipment."

While budgets, or lack thereof, seem to be a common topic of discussion at many professional conferences, monetary considerations do not appear to have a significant influence on purchasing decisions. For the second consecutive year, survey respondents ranked price next to last of the 12 categories most likely to influence a purchase. Other factors receiving write-in votes included ease of product usage, delivery time and vendor stability.

The breadth of considerations involved in datacomm management, whether in purchasing, implementation or operation, represents a significant frontier for many DP/MIS administrators. While such responsibility can be a burden, DP/MIS managers can take heart in knowing that success is possible, as evidenced by the handful of respondents who indicated they have no current problems with datacomm. (N)

Types of Data Communications Systems Being Used

	Presently Have		Don't Have Now But Plan to Add in Next 12 Months		Total that Have or Plan to Add in Next 12 Months	
	No.	Percent	No.	Percent	No.	Percent
Local Systems (on-site, campus)	1,087	93.7%	48	4.1%	1,135	97.8%
Metropolitan Area Systems	335	28.9%	97	8.4%	432	37.3%
Long Distance Systems	621	53.5%	127	10.9%	748	64.5%
Total-One or More Systems	1,109	95.6%	226	19.5%	1,147	98.9%
Total Respondents	1,160	100%	1,160	100%	1,160	100%

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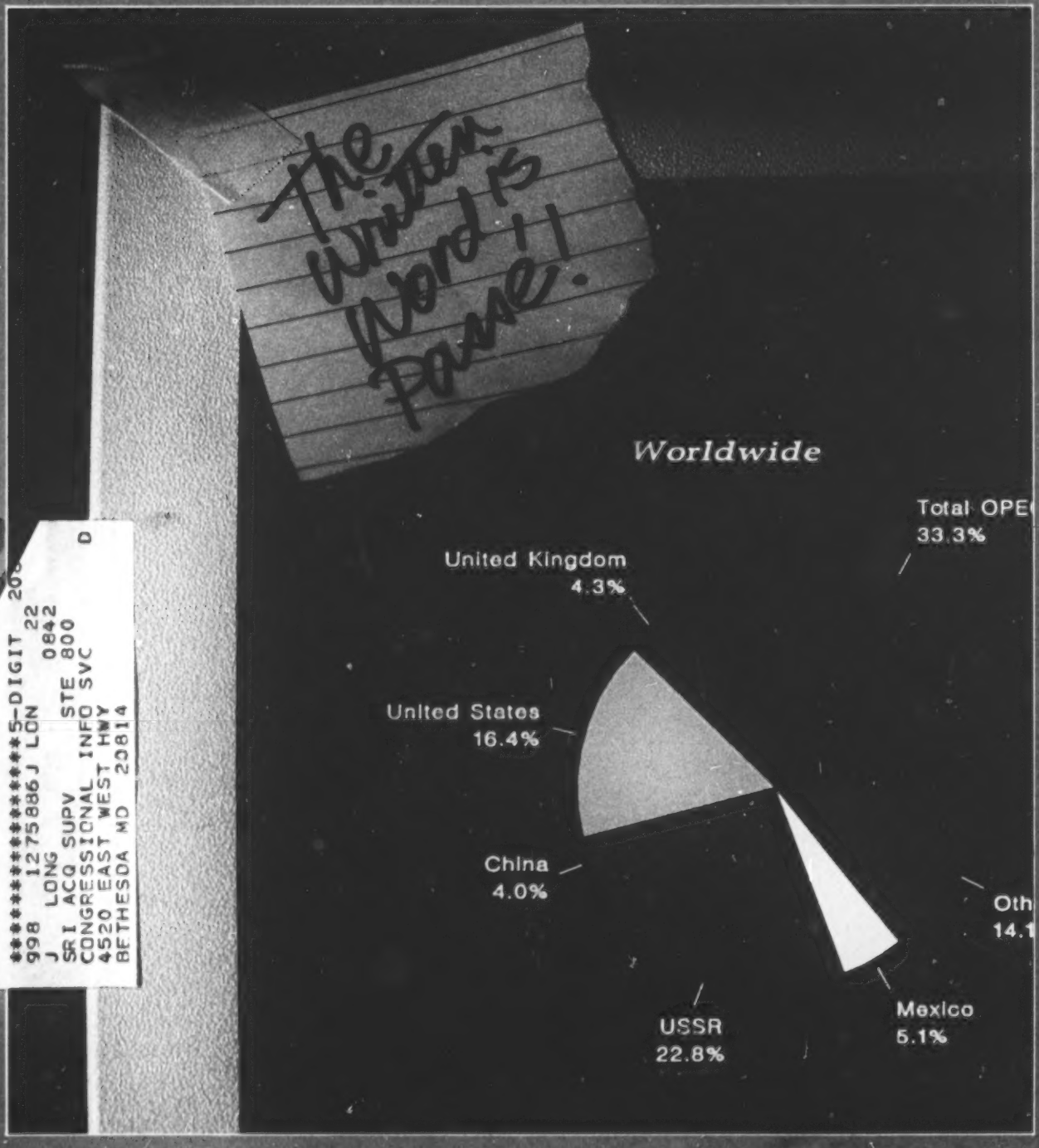
PC Communications • Making Unix Secure

15th Annual Micrographics Usage Survey • Artificial Intelligence

Data Security Products



ISSN 0364-5533

INFOSYSTEMS

THE MAGAZINE FOR INFORMATION SYSTEMS MANAGEMENT

April 1985 Volume 32 Number 4

22

70

54

74

FEATURES

22
The Written Word Is Passé
More information is being presented in graphic form for quicker analysis and enhanced presentation.

30
The Information Management Charter
Information systems managers may be in the best position to lead more efficient and profitable state-of-the-art enterprises.

34
Inforum: **A Programmer By Any Other Name . . .**

38
Data Security Products: What's Available?
With the intense competition going on in hardware and software markets, purchasers must try to determine the long-term viability of products they select.

42
For the Sake of Security: **Need Vs. Overkill**

46
Snyders on Software: **The Last Generator**

54
15th Annual Usage Survey: **Sizing Up Micrographics**

62
Spotlight: **The Micrographics Gospel**

68
Micro Business: **The 'Burden' of PCs**

70
Maximizing Data Center Efficiency
Adopting a customer service orientation and using a software package can lead to customer satisfaction and fewer DP job reruns.

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72
Selecting a Systems Development Methodology
A package offering many techniques does not necessarily conform to the needs and business mission of an organization.

74
Artificial Intelligence: Is MIS Ready for the Explosion?
As natural language and expert systems revolutionize the way corporate users manipulate information, DP and AI will become working partners.

84
Communications: Reconciling Differences
The equipment and software is available for transferring information between 'incompatible' computers.

88
'Salting' the Password
Barriers have been set up to prevent unauthorized access to Unix-based systems, but these must be understood and implemented correctly.

INSIDE INFO

10 Integration of prime importance as technology and needs change
12 'If you're going to be a survivor, you have to be a participant'
13 ADAPSO goes after PC pirates
14 Inadequate workplace integration, rule rather than exception
15 Cash prize to 'real' 4GL parent

APPLICATION REPORTS

37 A Window to PC Flexibility
83 More than a Trial Run
92 The 'Snowballing' Effect

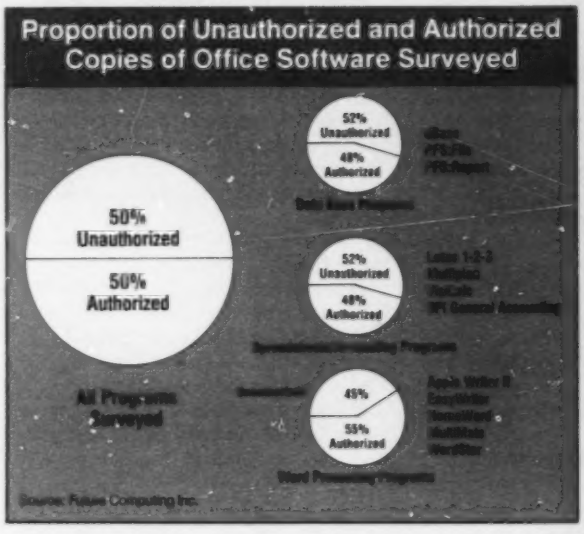
DEPARTMENTS

6 Feedback
8 Editor's Perspective
16 IN Brief
18 Arnie
48 Info Software
94 Products/Services Info
101 New Micro Products
103 Literature
104 Plan Ahead
104 Bookcase
106 Ad Index

ADAPSO goes after PC pirates

Personal computer (PC) software vendors have been complaining for years about the revenues lost to software piracy, or the unauthorized duplication and distribution of their products. A recent study by Dallas-based research firm Future Computing suggests that vendors have a good reason to howl: fully one-half of all copies of popular PC software are pirated, which will cost the industry an estimated $.8 billion in 1985. The Assn. of Data Processing Service Organizations (ADAPSO) is angry about this. At a press conference, the Arlington, VA, trade group unveiled plans for a three-pronged attack on piracy.

Legal Action. ADAPSO announced a lawsuit filed jointly with MicroPro, located in San Rafael, CA, against the Chicago-based Wilson Jones Co. and parent company American Brands. The suit charges Wilson Jones with distributing pirated copies of WordStar and other MicroPro software at its sales training seminars; it asks for $225,000 for breach of license, plus profits from the bogus copies, damages, penalties and legal fees. ADAPSO claims this is the first of a series of suits it will file against Fortune 2500 companies that pirate software. The group says it will also try to get Congress to stiffen software piracy laws.



Education. ADAPSO will be distributing brochures designed to enlighten the good, the bad and the uninformed about the realities of piracy as ADAPSO sees them. The gist of the message is that piracy is damaging to the industry, unethical and simply illegal.

Software locks. ADAPSO is developing a model hardware and software scheme that prevents unauthorized use of software. The model calls for a software "lock" that is written into the vendor's product to communicate with a small low-cost peripheral, confusingly named a "key ring." To access the product, the user would first have to insert something resembling a house key into the key ring. ADAPSO will be calling on vendors to adopt its model. Many PC products currently incorporate software-only locks designed to prevent duplication, but the Future Computing study indicates that such locks do not seem to impede pirates. One advantage of the ADAPSO scheme is that authorized users will be able to duplicate programs for legitimate purposes such as backup and hard disk use.

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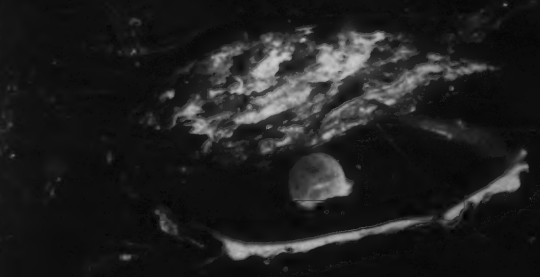

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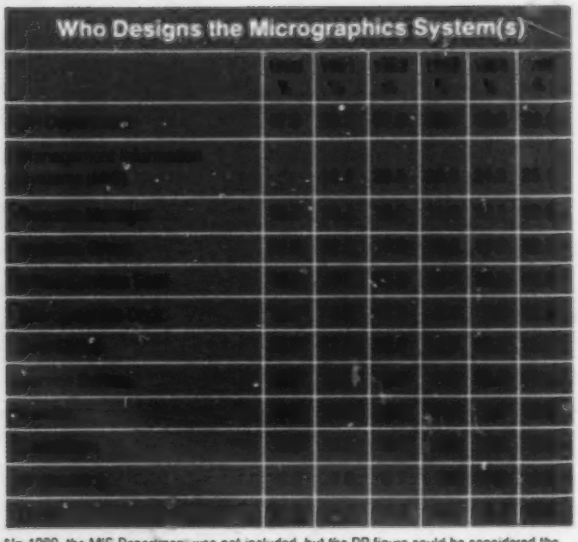
15th Annual Usage Survey

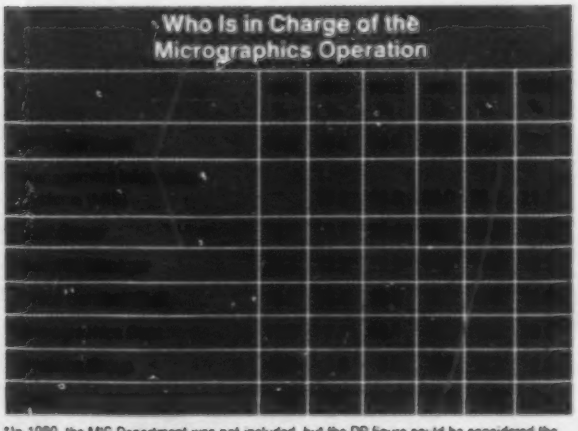
Sizing Up Micrographics

With overall use up slightly, DP/MIS managers continue to shoulder operations responsibility.

By Chuck Cozette, Associate Editor



*In 1980, the MIS Department was not included, but the DP figure could be considered the combination of DP and MIS.



*In 1980, the MIS Department was not included, but the DP figure could be considered the combination of DP and MIS.

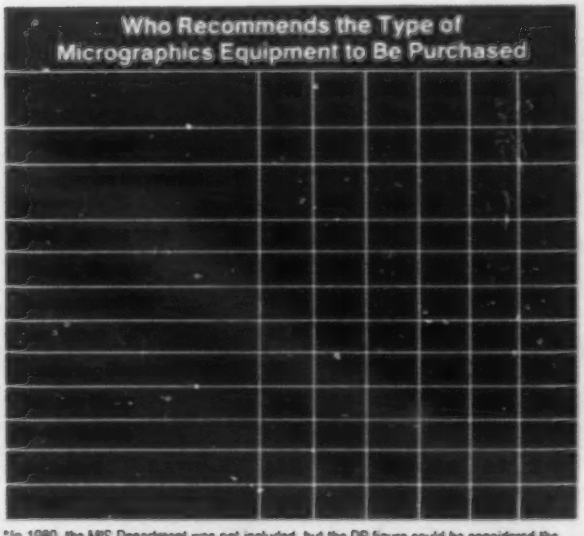
The larger and/or more bureaucratic the company, the greater its dependence on micrographics.

That is one conclusion drawn from INFOSYSTEMS' 15th Annual Micrographics Usage Survey which showed a direct correlation between a company's size and its use of microforms and micro-image storage and retrieval. A second significant factor, according to the survey, is the nature of a company's business, with inherently bureaucratic industries like banking, utilities, insurance, and the government and military heading the list of micrographics users.

Seventy percent of the companies surveyed that have 1,000 or more employees use some form of micrographics, compared to only about 20 percent of companies employing 50 or less. While only 37 percent of the total number of companies surveyed use micrographics, more than 87 percent of banking-related firms do.

The survey, conducted by Hitchcock Marketing & Research Services, Wheaton, IL, was mailed to 7,435 companies and drew 1,560 responses—a 21 percent return.

One factor not affected by the nature of a company's busi-



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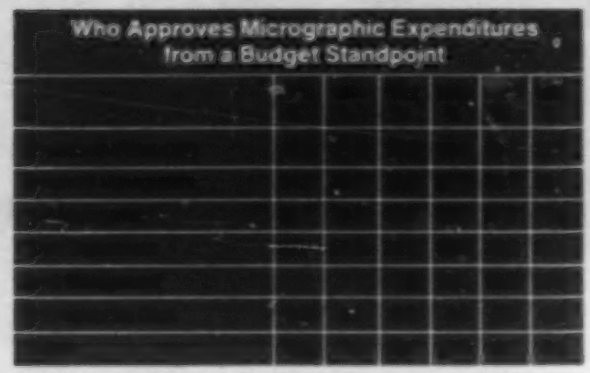
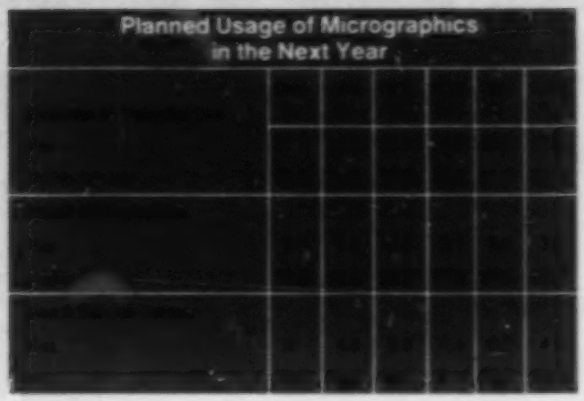
15th Annual Usage Survey



*In 1980 and 1981, the MIS Department was not included, but the DP figure could be considered the combination of DP and MIS.

ness or its size appears to be the responsibility for micrographics operations and systems design. That responsibility typically rests with data processing/management information systems (DP/MIS) managers, according to the survey. Sixty-four percent of survey respondents indicated that their DP/MIS managers were responsible for the total micrographics function up to the point of purchase approval. At that juncture, the DP/MIS manager's role decreases in direct proportion to increased involvement by corporate and financial management, as well as the user department.



While overall use increased slightly over the past two years, micrographics has not shown the kind of growth anticipated. For example, in each survey over the past six years, almost one-third of the respondents who said they were not using micrographics indicated they would be evaluating its potential during the coming year. With the exception of an actual decline in usage from 1981 to 1983, however, survey results indicate a relative stagnancy in the implementation of micrographics since 1980.

Survey administrator Ray Winkler, manager of market research at Hitchcock, believes these figures might be misleading. "Based on the responses we see each year, I think many people are still confused as to what micrographics encompasses," he said. Although efforts were made to clarify terminology by including a definition on the survey, Winkler thinks

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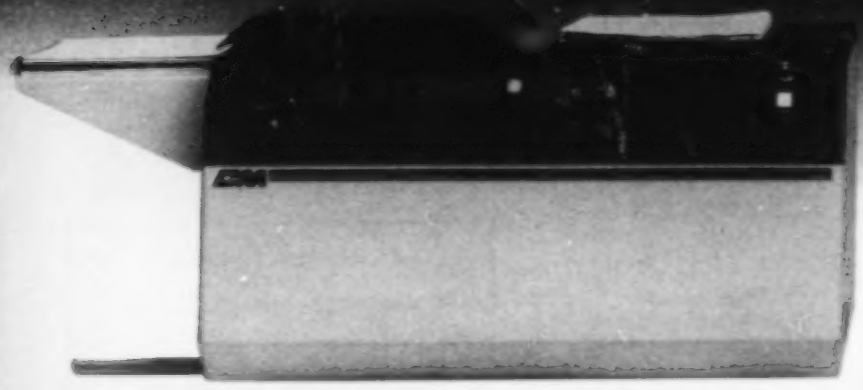

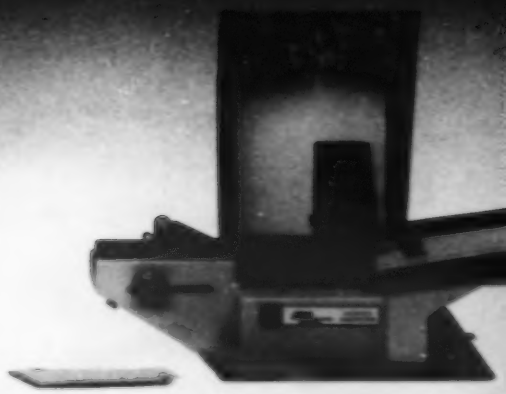

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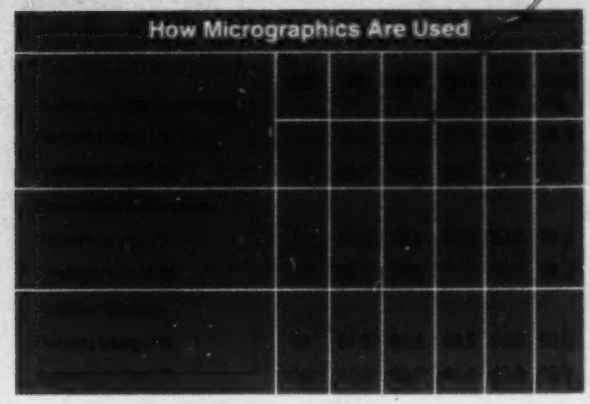

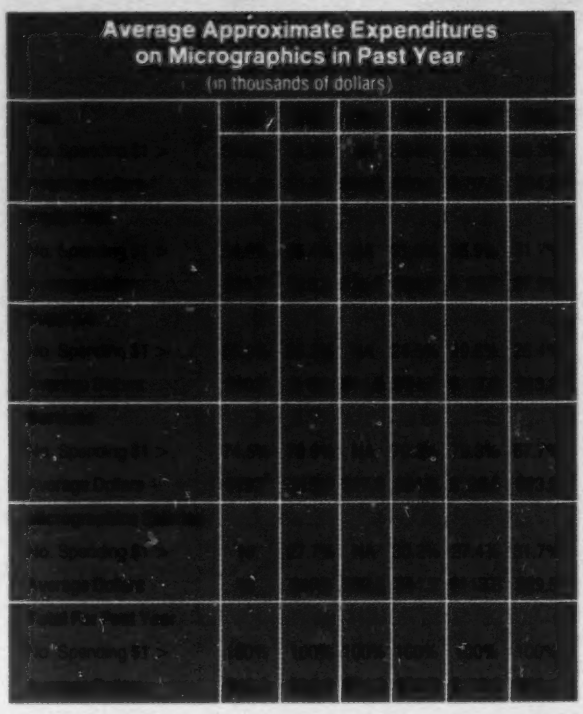

there still are many respondents who said they don't use micrographics when it really is being used. They either don't realize it or call it by another name.

"Those who use an outside service bureau sometimes do not consider themselves to be using micrographics," Winkler explained. "Some say they use microfilm or fiche, but do not consider themselves using micrographics; and others are unknowledgeable about the more sophisticated or newer technological forms of micrographics."

As defined by the survey, micrographics is "an all-encompassing term now generally accepted to include the creation and usage of all types of microforms and micro-images such as microfilm, microfiche and computer-output microfilm (COM)."

The primary function of micrographics, representing almost half of all usage, is for archival storage, according to the survey. Another 30 percent of micrographics users actively ref-

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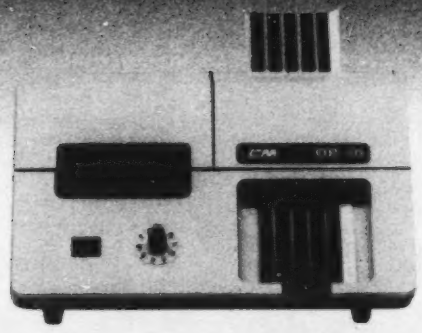

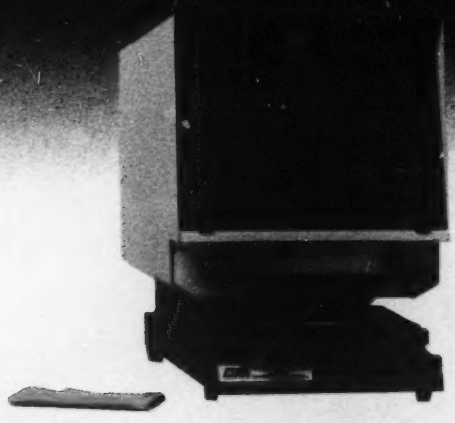

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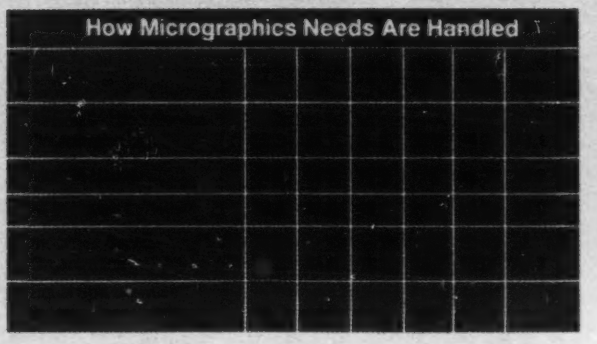

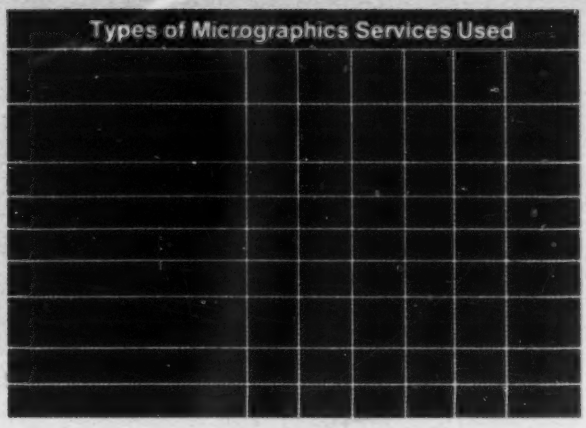

erence stored data on a daily basis, while 20 percent describe their reference needs as semi-active.

Service firms carry much of the micrographics work load, with more than 80 percent of those using micrographics contracting at least part of their work to service bureaus. Forty-four percent handle micrographics exclusively through service firms, 10 percent have most of their work done outside and another eight percent split the work evenly between in-house and outside services. Only 19 percent of the companies involved in micrographics do it all on their own, according to the survey.

"We avoid designing programs in-house in order to keep internal staff to a minimum," said one respondent at a large federal agency. "Generally, the only use of in-house micrographic programs and staff is on occasions where the security level of documents precludes the use of service bureaus."

Dependence on service bureaus is likely to continue, according to the survey. Eighty-six percent of those using micrographics expect little change in the way it is handled in the next year; only nine percent plan to do a larger share in-house; and five percent expect to increase use of service bureaus. This dependence is not universal, however. An industry breakdown revealed that more than 20 percent of respondents at financial and utility companies plan to increase in-house micrographics work.

For users of service bureaus, COM was used twice as often as the next highest mentioned service. More than three out of four respondents used service bureaus for COM: 38 percent to convert documents to film; 31 percent to process film; and 25 percent to duplicate film.

In-house COM usage has remained relatively stable (17 per-

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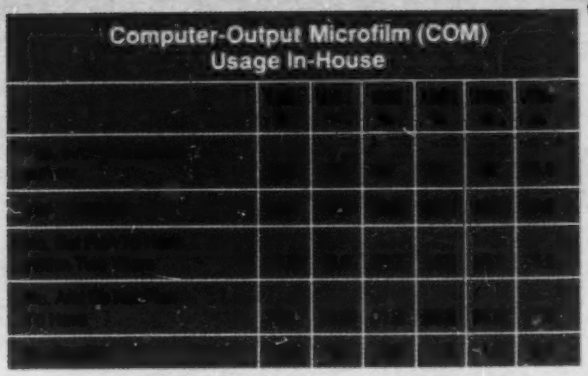

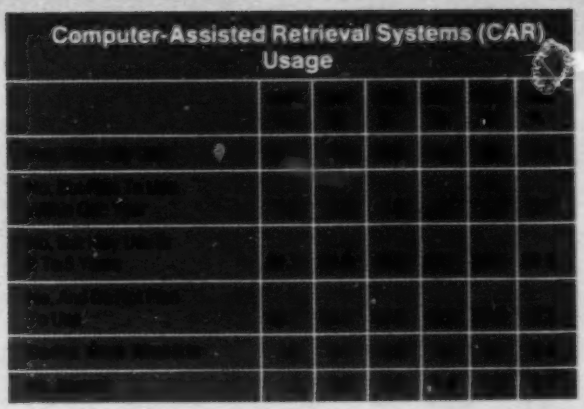

cent this year) since 1980, according to the survey, while use of computer-assisted retrieval (CAR) systems has increased only slightly (12 percent this year). Of those currently using CAR, 41 percent use a mainframe-controlled unit, 39 percent use a standalone retrieval unit and 16 percent use both. Transportation and insurance firms are the biggest users of CAR, according to the survey.

Although magnetic tape and computer files also were mentioned, paper and hard copy remain the most often used alternatives to micrographics. While some might believe dependence on paper is unforgivably old-fashioned, others hold similar feelings toward micrographics—at least as they understand the term.

"We don't believe micrographics has a future," said one respondent not presently using micrographics. "We're planning on optical laser disk or some other computer-accessible and readable media to gradually replace our paper storage."

Reduced spending in 1985, down almost 14 percent from a year ago, might seem to support such a negative forecast for micrographics usage. Total spending is still higher than it was in 1983, however, and almost double 1981 expenditure levels. (IN)

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Complete Reports Available

Complete spiral-bound copies of the backup summary of the survey are available for $50. This summary includes a detailed breakdown, by industry, for each of the survey's 18 questions. Check or company purchase order must accompany all orders. Mail request to INFOSYSTEMS Micrographics Survey, Research Department, Hitchcock Publishing Co., 25W550 Geneva Road, Wheaton, IL 60188.

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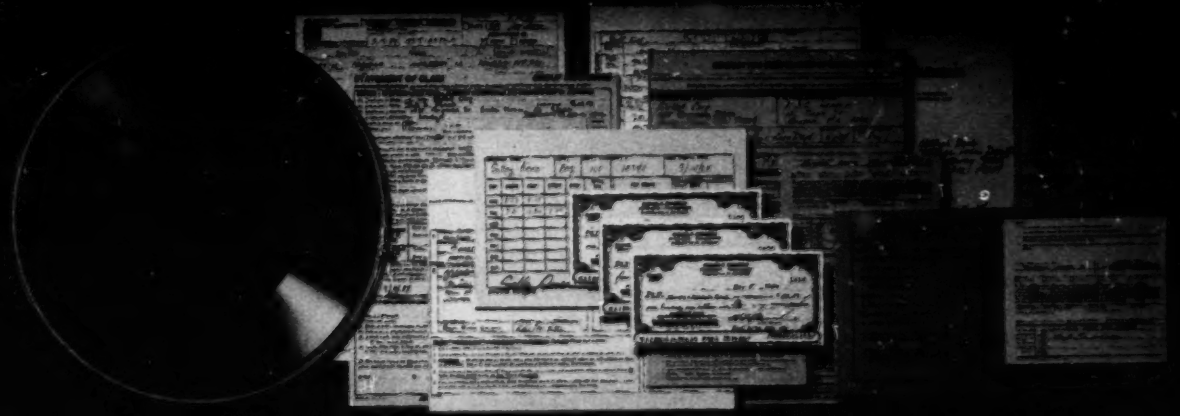

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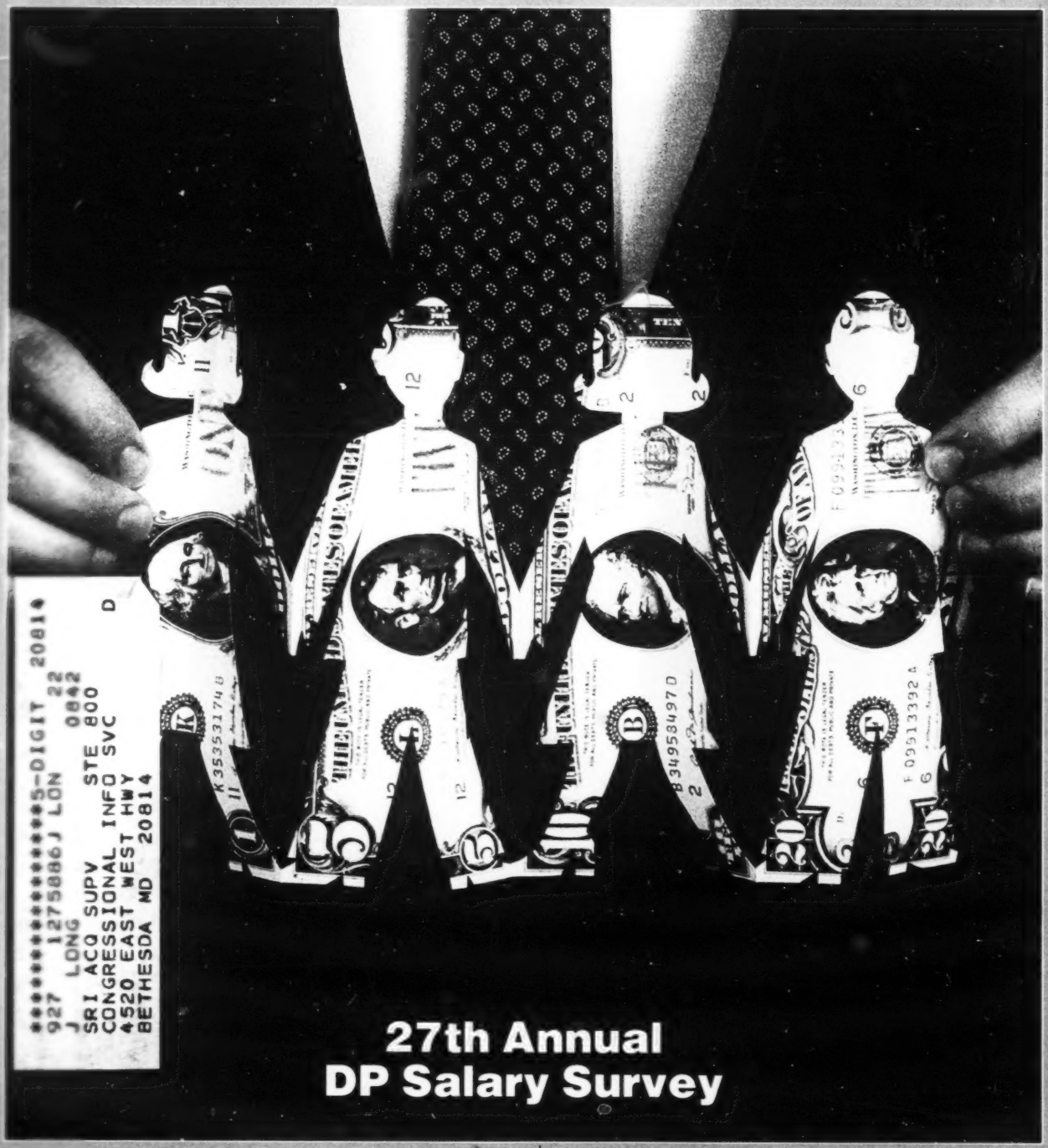

27th Annual DP Salary Survey

INFOSYSTEMS

THE MAGAZINE FOR INFORMATION SYSTEMS MANAGEMENT

ISSN 0364-5533

June 1985 Volume 32 Number 6

27

56

40

59

FEATURES

24
Inforum: **Fitting IS into the Organization**

27
27th Annual DP Salary Survey: **Prosperity Continues**

40
Installing a Solution Center: Think Big, Start Small
In a center that provides access to corporate information resources, end users can do their own information processing with professional support.

46
Dialing for Data with Multifunction Workstations
Common to all IVDTs is software technology that serves as a distributed operating system for voice and data communications.

50
Snyders on Software: **The Nth Version of Software**

52
The Science of MIS Planning
If personnel and staffing costs are not accurately projected, the entire department's budget is in jeopardy.

54
Technology Info: **One More Step for Unix**

56
Evaluating CAD/CAM Systems: Priorities & Integration
Computer-aided design/computer-aided manufacturing systems can have a startling effect on fundamental business elements.

59
The Benefits of Programmer Productivity Software
With the right tools, MIS managers can convert from one system to another, modify old systems, and even train new employees in a quick and cost-effective way.

66
The New Economics of Computers
Although earlier predictions have been off the mark, two things are certain: the cost of electronic circuitry continues to fall, and the market for computers continues to soar.

85
Spotlight: **Is Voice Messaging Still on Hold?**

92
For the Sake of Security: **Protection on the PC**

96
Personal Computers: Management Tools or Executive Toys?
PCs can be used to the best advantage if they are implemented to accomplish business objectives.

INSIDE INFO

14 IS executives may find themselves assuaging an end-user revolt
16 Amway-style marketing approach could help limit software piracy
17 Special talents evident in maintenance programming
18 CBT can exhilarate users once they know how to 'fall down'
19 US industry's ability to compete declining, commission says

DEPARTMENTS

8 Feedback
10 Editor's Perspective
20 Arnie
100 Products/Services Info
108 Ad Index

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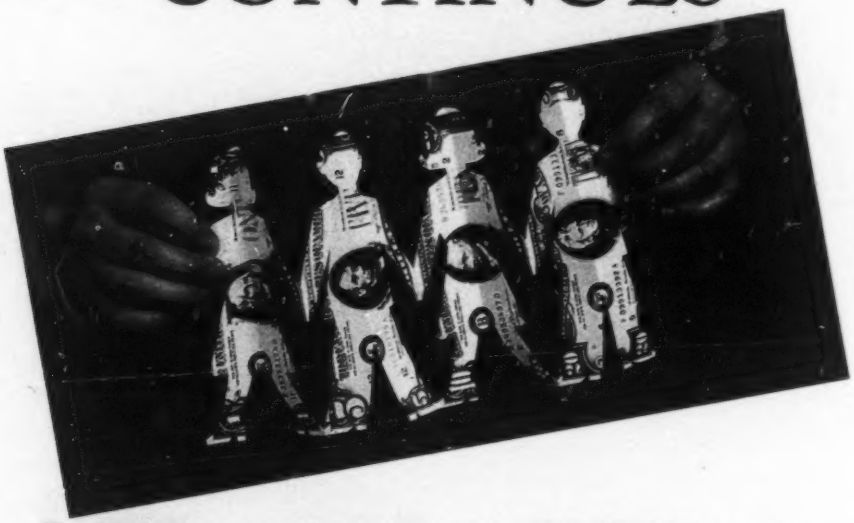
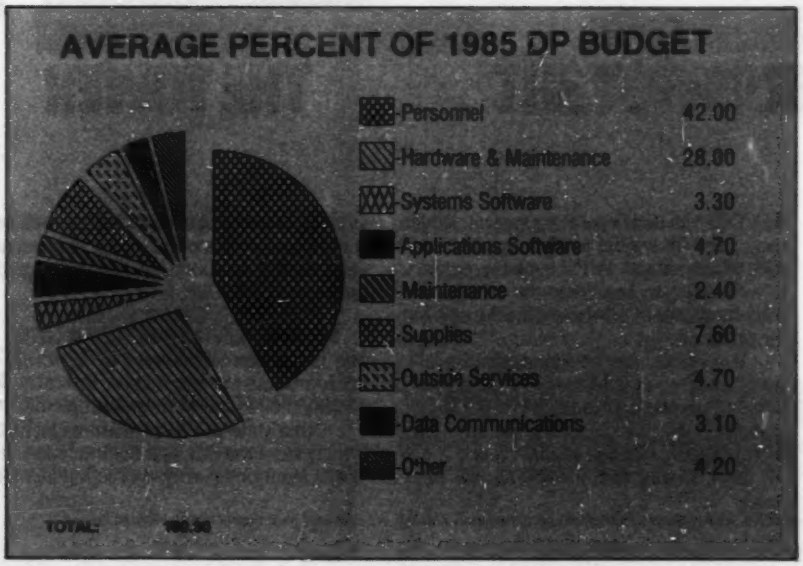
PROSPERITY CONTINUES



Data base systems managers led the way as data processing salaries rose an average of almost eight percent.

By Chuck Cozette, Associate Editor



If money talks, then the creation and maintenance of strategic data bases is becoming an increasingly critical priority in corporate data center operations.

The individual charged with this responsibility, the data base systems manager, led all job titles in percentage salary increase, according to INFOSYSTEMS' 27th Annual Data Processing Salary Survey. Data base managers' salaries rose 21 percent to an average of $849 a week, up almost $150 a week from last year's levels.

It was also a good year for lead and senior analysts/programmers, most of whom received salary increases ranging from 9 to 17 percent. The average increase for all data processing (DP) job titles was about eight percent, a full percentage point higher than last year.

Public utilities, insurance firms and DP service companies were among the

27th Annual DP Salary Survey

highest paying employers. DP personnel in the field of education continued to receive the lowest pay levels.

The 1985 survey is based on responses from 790 firms drawn from the top 50 US metropolitan areas according to computer installations and usage. The respondents reported on 8,863 full-time positions. The survey, conducted by Hitchcock Marketing Services, Wheaton, IL, reflects salaries in effect on March 1, not including bonuses or other benefits.

Average salaries for top management information systems (MIS) officials and DP managers rose less than the industry average: MIS managers up three percent to $1,062 a week, and DP managers up four percent to $752 a week. The highest salary reported for a MIS officer was $2,308 a week, or about $120,000 per year.

The average assistant DP manager's salary, up 13 percent, was only one dollar less than that of the average DP manager. These figures are somewhat misleading, however, because the position of assistant DP manager is usually limited to larger firms with correspondingly bigger DP departments and budgets, explained Ray Winkler, manager of market research at Hitchcock. The salary average for the DP manager, on the other hand, is "diluted" by responses from small companies, some of which have only one or two people in their DP departments. The scope of these managers' responsibilities, and their corresponding salaries, are often less than that of an assistant manager at a large firm.

As might be expected, geographic location had a significant influence on salary levels. Firms in regions in the country lacking in major metropolitan areas reported notably lower salaries than regions with higher concentrations of urban areas. Average salaries for DP personnel in the West North Central states (MN, ND, SD, NB, IA) ranked last among geographic areas in 21 of the 36 job titles. Salary levels in East South Central states (KY, TN, MS, AL) were below the national average for all but two job titles.

DP personnel working in cities also averaged six percent higher salaries than their suburban counterparts, although this is down from seven percent last year. In New York City, where salaries are among the highest in the country, the city/suburban differential fell from 13 percent to nine percent. In sprawling Los Angeles, where city/suburban boundaries are far less defined, the salary differential was only three percent.

In addition to salary information, the survey gathered data about staffing, budgeting and computer operations.

The average number of employees in DP departments remained stable at 20. This number of employees would correspond to a company with between 1,800 and 1,900 total employees and the rental equivalent of about $50,000 in monthly equipment costs, according to the survey. Companies spending $150,000 or more per month for equipment averaged almost 180 DP employees.

Finding and retaining DP personnel continues to be a challenge, as almost 60 percent of survey respondents reported turnover in their departments. More than one in seven DP employees were new to their jobs, compared to almost one in eight last year when only 50 percent of survey respondents reported turnover. With 27 percent of respondents reporting salaried, nonclerical departmental vacancies, this job turnover is likely to continue. Companies with vacancies reported an average of more than three unfilled positions, up from an average of two last year.

More than two-thirds of full-time DP personnel are salaried. The remaining 30 percent work on an hourly basis, according to the survey. Of those companies that had hourly, full-time DP personnel, an average of six percent of related costs were for overtime.

The percentage of overall DP budget spent for personnel remained steady at 42 percent. Expenditures for personnel have dropped only slightly during the last five years, from a high of 45 percent of total budget in 1980.

Software continued to claim an increasingly larger portion of the DP budget while hardware expenditures continued to decline. Software represented 10 percent of the average DP budget, almost half of which was allocated for application software. Average hardware expenditures decreased a fraction of a percentage point to 28 percent of the total DP budget: 11 percent of which was spent on computers, 10 percent for maintenance and 7 percent for peripherals.

The financial officer remained DP's primary link to corporate management. Thirty-eight percent of respondents indicated their DP manager reported to the controller or treasurer; 33 percent to the president, owner or general manager; 11 percent to a vice president; and 9 percent to the MIS director.

Two key issues facing most DP departments are data security and centralized control of microcomputers. Of the 57 percent of respondents indicating centralized control for microcomputer acquisition and implementation within their companies, two-thirds said budgetary responsibility rested with DP or MIS management. Less than two percent of survey respondents said they have a full-time data security specialist on staff. Eleven percent indicated having a part-time data security specialist.

Salary Breakout

A comprehensive breakout of salary information can be found in chart form on the following pages: by geographic area, page 32; by size of installation, page 37; and by industry, page 38. (N)

For an extra copy of this article, please enter No. 12 on the Reader Information Card.

Number of Employees in DP vs. Company

(By Equipment Rental Range)

Rental Range Per Month	Average Number In DP	Average Number In Company
Under $3,000	4.7	294.8
$3,000 To $4,499	5.9	208.8
$4,500 To $5,999	6.5	362.9
$6,000 To $8,999	7.2	405.8
$9,000 To $11,999	8.4	472.5
$12,000 To $14,999	8.4	584.8
$15,000 To $17,999	11.0	888.6
$18,000 To $24,999	13.9	721.5
$25,000 To $49,999	18.0	1781.6
$50,000 To $74,999	28.4	2053.6
$75,000 To $99,999	43.0	2396.7
$100,000 To $149,999	67.3	2811.2
$150,00 And Over	179.8	7225.4
Not Available	41.6	2130.2
All Companies	18.5	1042.6

Job Descriptions Available

Detailed job descriptions for the 36 DP positions surveyed are available free of charge. For a copy, enter No. 138 on the Reader Information Card.

Complete DP Salary Survey

A complete copy of the INFOSYSTEMS 1985 DP Salary Survey can be ordered for $195. The report includes replies to the 18 questions in the study by industry and equipment rental range, as well as salary data for the 36 job functions. Send your check or company purchase order to Hitchcock Executive Book Service, Hitchcock Building, 25W550 Geneva Road, Wheaton, IL 60188.

27th Annual DP Salary Survey

Average Reported Weekly Salaries by Geographic Area

Job Description	Job Code	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	National Average 1984	National Average 1985	% Increase/Decrease
MANAGEMENT		(34)	(118)	(91)	(199)	(16)	(70)	(65)	(29)	(112)	(905)	(745)	—(No. Firms)
Top MIS Official	(01)	1175	1047	1093	1034	940	1042	1188	1055	1035	1029	1062	+3.2
Data Base Systems	(02)	740	962	764	805	849	882	795	772	723	702	849	+20.9
Data Processing	(03)	815	753	720	744	758	694	806	821	760	721	752	+4.3
Ass't. DP	(04)	783	684	732	785	693	744	678	729	750	663	751	+13.3
[illegible]													
[illegible]	(05)	717	847	853	783	632	778	819	855	881	787	753	+4.1
Systems Analysis and Programming													
Manager/Supervisor	(06)	788	851	689	764	648	706	762	795	764	732	751	+2.6
Lead	(07)	675	656	677	696	535	639	683	679	605	613	664	+8.3
Senior	(08)	579	606	560	600	499	526	601	666	599	550	646	+17.5
Junior	(09)	497	565	457	541	365	483	552	502	439	445	517	+16.2
[illegible]													
[illegible]	(10)	753	915	788	787	798	707	913	860	876	779	859	+7.5
[illegible]	(11)	691	722	730	750	700	666	731	754	743	611	710	+16.2
[illegible]	(12)	577	660	632	621	619	613	590	544	621	591	616	+4.2
[illegible]	(13)	561	501	548	561	576	534	524	529	512	520	547	+5.2
Systems Programming													
Manager/Supervisor	(20)	889	853	745	763	769	770	798	873	765	743	784	+5.5
Lead	(21)	742	765	704	730	624	664	689	767	669	644	737	+14.4
Senior	(22)	613	656	607	600	568	619	663	655	622	573	627	+9.4
Junior	(23)	509	544	560	510	**	465	594	524	476	444	524	+18.0
Trainee	(24)	430	500	446	502	440	326	419	487	456	344	466	+35.5
[illegible]													
[illegible]	(25)	680	677	647	687	574	634	755	738	562	709	644	−6.8
[illegible]	(26)	624	640	641	647	469	552	625	658	573	545	606	+11.2
[illegible]	(27)	520	563	508	572	413	448	496	588	546	467	509	+9.0
[illegible]	(28)	421	436	430	424	320	392	476	479	413	392	450	+14.8
[illegible]	(29)	333	329	367	334	280	317	355	390	380	298	344	+15.5
Data Communications													
Manager	(30)	615	511	568	592	600	582	664	679	757	612	618	+1.0
Operator	(31)	372	422	362	478	405	400	503	449	395	390	431	+10.5
[illegible]													
[illegible]	(32)	503	539	532	496	427	528	572	547	602	531	532	+0.2
[illegible]	(33)	365	446	398	375	335	356	412	414	407	382	396	+3.7
[illegible]	(34)	337	376	348	353	320	326	349	385	390	340	358	+5.3
[illegible]	(35)	272	280	307	280	253	282	298	308	317	282	297	+5.3
I/O Control Manager	(36)	348	347	394	419	295	402	356	318	380	366	372	+1.6
Tape Librarian	(40)	278	272	298	334	275	275	284	331	300	301	297	−1.3
[illegible]	(41)	512	545	533	476	425	344	402	491	516	78	450	——
Data Entry													
Supervisor	(42)	407	365	380	373	361	371	363	401	415	362	375	+3.6
Lead Operator	(43)	294	280	311	318	297	288	298	273	334	294	301	+2.4
Senior Operator	(44)	281	254	307	273	223	251	248	309	311	277	271	−2.2
Junior Operator	(45)	222	222	264	239	165	232	242	289	280	218	241	+10.6

NI = Not included **Indicates insufficient information available

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Weekly Salaries for All Jobs: Nationwide and by Size of Installation

Job Description	Job Code	NATIONAL STATISTICS: Number Reported	Lowest Reported Actual Salary	25th Percentile* Actual Salary	National Average Actual Salary	Median* Actual Salary	Mode* Actual Salary	75th Percentile* Actual Salary	Highest Reported Actual Salary	Established Salary Range—Average Low	Established Salary Range—Average High	AVERAGE SALARY—BY EQUIPMENT RENTAL RANGE: Under $3,000/Mo.	$3,000-4,499/Mo.	$4,500-5,999/Mo.	$6,000-8,999/Mo.	$9,000-11,999/Mo.	$12,000-14,999/Mo.	$15,000-17,999/Mo.	$18,000-24,999/Mo.	$25,000-49,999/Mo.	$50,000-74,999/Mo.	$75,000-99,999/Mo.	$100,000-149,999/Mo.	$150,000 and over
MANAGEMENT												(112)	(90)	(62)	(86)	(61)	(45)	(39)	(47)	(82)	(41)	(16)	(15)	(34)
Top MIS Official	(01)	177	461	923	1062	996	923	1211	2308	907	1239	991	1009	1035	983	1035	947	1020	1040	1039	1050	1098	1204	1445
Data Base Systems	(02)	55	385	684	849	828	961	1057	1500	684	1020	690	701	**	**	**	707	**	623	792	793	746	752	1108
Data Processing	(03)	581	307	615	752	759	865	884	1384	627	901	605	640	688	720	768	779	785	792	841	880	890	906	1055
Ass't. DP	(04)	101	346	657	751	782	1076	907	1192	584	839	600	603	663	664	746	**	699	754	798	784	853	887	953
Project/Team Leader																								
Leader	(05)	278	413	673	783	787	908	975	1019	572	838	413	582	547	541	624	517	735	702	707	685	719	827	834
Systems Analysis and Programming																								
Manager/Supervisor	(06)	239	346	644	751	738	673	865	1586	620	904	651	739	606	624	648	709	680	705	698	802	791	828	846
Lead	(07)	264	317	576	664	667	826	769	1026	529	732	597	707	527	606	568	629	636	585	665	615	673	802	795
Senior	(08)	799	346	542	646	673	757	757	923	484	682	566	634	506	548	566	565	579	565	604	580	557	612	718
Junior	(09)	464	259	434	517	528	626	626	769	396	561	490	578	382	477	408	378	407	443	470	474	453	561	600
Systems Analyst																								
Manager/Supervisor	(10)	36	450	699	859	807	1076	1076	1211	610	869	690	**	**	**	**	**	**	725	**	765	**	782	1030
Lead	(11)	88	442	650	710	710	807	807	1000	585	817	640	**	**	543	**	609	**	625	682	723	**	752	731
Senior	(12)	156	268	553	616	617	634	665	961	493	714	544	**	**	518	486	**	632	622	635	618	654	673	667
Junior	(13)	67	220	473	547	543	626	618	770	441	647	432	**	**	450	477	420	**	471	485	507	543	541	727
Systems Programming																								
Manager/Supervisor	(20)	76	365	705	784	778	769	865	1153	668	967	**	**	**	**	**	**	**	729	788	748	769	827	874
Lead	(21)	84	489	635	737	716	750	826	1211	571	819	614	**	**	**	**	**	**	**	617	646	726	751	828
Senior	(22)	154	270	543	627	640	673	702	961	513	735	579	533	**	497	458	478	**	507	544	618	688	728	755
Junior	(23)	131	270	423	524	528	626	626	788	434	620	496	437	**	396	399	374	393	488	485	522	557	627	533
Trainee	(24)	46	259	373	466	469	559	559	646	395	557	458	**	**	**	370	369	**	336	372	**	496	**	521
Application Programming																								
Manager/Supervisor	(25)	78	346	530	664	676	807	761	1201	583	819	538	**	**	**	642	564	579	680	707	679	696	846	711
Lead	(26)	262	307	500	606	592	768	693	969	485	715	490	505	538	504	550	557	562	606	591	598	568	728	623
Senior	(27)	557	250	442	509	500	482	557	865	426	603	476	468	503	443	485	430	448	466	538	513	483	630	541
Junior	(28)	555	200	370	450	423	461	489	353	354	511	415	457	387	342	356	372	400	377	436	413	399	517	451
Trainee	(29)	168	154	281	344	340	376	364	514	294	426	339	285	270	237	259	246	262	305	368	335	331	393	395
Data Communications																								
Manager	(30)	36	320	489	618	615	615	758	1057	507	712	**	**	**	**	320	**	475	**	689	474	639	736	703
Operator	(31)	70	200	346	431	386	384	478	965	375	536	327	**	380	**	374	**	323	324	449	408	428	497	485
Computer Operations																								
Manager/Supervisor	(32)	301	211	423	532	525	384	655	1188	466	670	605	444	406	472	482	486	448	583	542	593	638	596	644
Lead Operator	(33)	373	193	326	396	376	384	449	875	329	461	386	334	321	369	360	373	355	356	372	401	452	466	533
Senior Operator	(34)	630	153	302	385	345	346	389	750	299	416	344	318	310	320	354	353	316	340	369	370	358	424	374
Junior Operator	(35)	584	150	250	297	288	288	346	500	230	353	250	257	268	275	282	308	242	272	288	276	325	353	331
I/O Control Manager	(36)	129	200	296	376	346	325	428	739	335	483	368	**	314	326	333	343	335	347	371	368	375	389	508
Tape Librarian	(40)	57	192	258	287	296	230	340	443	261	374	333	**	**	302	**	**	**	287	281	315	301	292	298
User Training Specialist	(41)	69	211	384	453	447	403	530	882	368	605	478	367	**	391	423	443	**	**	481	482	436	**	468
Data Entry																								
Supervisor	(42)	110	226	300	375	362	346	432	633	320	458	358	311	357	344	316	352	409	392	372	399	386	417	441
Lead Operator	(43)	212	184	260	301	300	288	342	548	257	361	264	269	318	301	314	326	318	320	290	305	321	324	359
Senior Operator	(44)	581	150	230	271	262	210	300	500	231	320	243	249	304	254	271	241	277	273	279	285	268	298	303
Junior Operator	(45)	235	144	204	241	240	230	276	442	201	282	233	224	226	242	210	217	219	228	243	259	260	266	280

*Median—A figure having an equal number above and below
*Mode—The salary reported most often
*25th Percentile—That point at which 25% of all other salaries are lower and 75% are higher
*75th Percentile—That point at which 75% of all other salaries are lower and 25% are higher

**Indicates insufficient information available

27th Annual DP Salary Survey

Average Reported Weekly Salaries by Industry

Job Description	Job Code																							
MANAGEMENT		(17)	(21)	(55)	(18)	(71)	(28)	(32)	(27)	(10)	(27)	(42)	(72)	(18)	(50)	(43)	(19)	(40)	(39)	(10)	(19)	(26)	(13)	(48)
Top MIS Official	(01)	1140	1180	869	1060	1054	1052	1165	1001	1326	1168	1050	1108	828	1053	1052	999	982	990	1038	**	1213	1154	1045
Data Base Systems	(02)	**	**	660	605	874	691	739	**	812	807	980	615	**	835	892	630	**	**	**	**	795	**	**
Data Processing	(03)	746	856	643	665	776	801	763	686	922	712	869	726	761	707	749	723	793	744	750	738	812	730	767
Ass't. DP	(04)	708	759	635	645	756	790	762	597	902	684	868	641	741	693	740	**	786	730	**	**	**	**	**
Project/Team Leader																								
Leader	(05)	853	728	709	**	718	768	787	631	785	655	752	851	757	744	712	**	704	818	**	**	772	729	819
Systems Analysis and Programming																								
Manager/Supervisor	(06)	818	805	599	725	702	760	755	**	828	802	771	786	743	695	774	693	779	709	**	**	691	**	819
Lead	(07)	722	591	517	632	669	540	711	**	785	684	707	678	656	583	625	614	670	619	634	596	656	**	672
Senior	(08)	608	553	506	606	541	521	569	592	754	610	682	481	595	547	585	605	617	590	**	577	627	559	638
Junior	(09)	466	466	452	500	406	385	530	**	625	481	605	441	527	450	380	590	453	530	**	**	537	432	573
Systems Analysis																								
Manager/Supervisor	(10)	**	781	**	**	841	**	733	**	876	**	**	619	**	754	785	**	**	**	**	**	**	**	**
Lead	(11)	**	718	**	**	686	694	706	**	816	**	**	597	**	**	692	725	**	613	**	**	**	**	**
Senior	(12)	624	619	471	480	569	592	698	**	796	566	610	564	616	**	590	659	568	604	**	**	**	**	**
Junior	(13)	**	573	441	**	527	561	540	437	642	**	525	**	563	**	467	**	418	**	**	**	**	**	**
Systems Programming																								
Manager/Supervisor	(20)	**	809	**	884	756	**	787	**	810	805	841	768	774	**	757	788	761	**	**	**	802	**	972
Lead	(21)	**	688	623	**	721	755	723	**	760	680	801	730	677	**	708	**	717	661	**	**	720	**	931
Senior	(22)	**	568	497	**	608	625	685	**	738	593	631	650	544	595	**	**	639	580	653	**	657	646	687
Junior	(23)	**	**	485	576	492	461	602	**	605	454	564	507	505	397	502	**	**	468	**	**	613	560	**
Trainee	(24)	**	**	307	**	419	408	384	**	541	**	496	448	**	**	424	**	307	**	**	**	**	**	**
Applications Programming																								
Manager/Supervisor	(25)	**	734	561	**	634	680	757	663	**	**	730	690	**	**	746	**	593	**	744	**	655	**	721
Lead	(26)	460	587	526	544	603	658	662	**	651	**	660	632	**	**	624	653	564	527	**	**	533	**	570
Senior	(27)	470	478	468	451	538	548	529	598	599	493	542	487	410	494	524	582	476	518	566	539	469	459	472
Junior	(28)	364	395	416	424	423	482	482	374	541	356	467	430	339	373	424	426	377	385	419	**	446	493	463
Trainee	(29)	328	297	308	346	354	403	353	345	464	326	299	285	**	279	304	332	331	388	304	**	336	**	361
Data Communications																								
Manager	(30)	**	517	480	**	540	596	618	**	**	**	718	**	543	**	**	**	**	**	**	**	**	**	**
Operator	(31)	381	350	**	**	400	408	398	384	**	**	442	**	470	**	456	**	**	301	**	**	**	**	**
Computer Operations																								
Manager/Supervisor	(32)	501	524	457	434	617	498	554	525	606	546	556	499	546	494	556	393	475	546	610	**	625	502	583
Lead Operator	(33)	382	332	350	357	450	441	402	346	530	421	417	347	447	357	413	359	397	347	454	353	396	349	416
Senior Operator	(34)	369	318	338	333	373	393	375	339	501	300	353	331	432	313	392	362	339	327	321	327	342	315	377
Junior Operator	(35)	253	250	284	279	317	335	345	258	336	280	263	274	301	259	268	246	273	285	260	284	299	280	314
I/O Control Manager	(36)	354	460	373	288	407	405	327	298	398	336	403	357	476	275	399	230	451	341	373	**	352	**	391
Tape Librarian	(40)	332	**	285	**	306	**	263	288	350	318	305	253	368	**	334	**	300	**	**	**	288	**	**
User Training Specialist	(41)	428	429	448	**	362	456	494	624	398	**	476	469	**	526	**	**	**	**	**	**	359	**	**
Data Entry																								
Supervisor	(42)	390	379	281	310	397	307	280	349	330	315	382	380	344	358	376	351	401	359	366	389	358	318	384
Lead Operator	(43)	358	298	276	279	314	289	253	265	277	279	314	311	314	304	315	326	318	289	295	319	306	288	307
Senior Operator	(44)	307	247	265	220	283	277	244	251	251	252	237	281	245	259	270	320	267	283	265	294	287	273	259
Junior Operator	(45)	263	188	260	214	267	270	232	206	226	227	225	231	240	233	223	252	242	251	205	232	247	220	234

Manufacturing and Processing

(No. Firms)

**Indicates insufficient information available

The New Economics of Computers

In the 1960s and early 1970s, two economic laws reigned supreme in the world of computers. The first, relating to economies of scale, stated that the larger the computer, the better its price/performance. The second applied to large systems shared by many users—the norm at that time—and stated that economies of scope were to be gained from sharing software and support resources among similar applications.

These economic laws no longer apply to many recently introduced computers and applications. Economies of scale may still apply, but only within narrow categories of equipment. With the economies derived from large-volume production of integrated circuit chips, microcomputers and superminicomputers often show better price/performance than the large machines.

The earlier benefits of spreading the costs of software and support among many users via timesharing are being challenged by inexpensive microcomputers that provide relatively cheap, easy-to-use software packages and are operated by novice users. At the same time, applications most suited to large computers, such as high-volume transaction systems and on-line data base applications serving many users, are becoming increasingly complex. The result is that the computer resources required to run such a system are increasing.

Although earlier predictions have been off the mark, two things are certain: the cost of electronic circuitry continues to fall, and the market for computers continues to soar.

By C. Warren Axelrod
Lewco Securities Corp.
New York, NY

In the turmoil of the computer industry, it is virtually impossible to extrapolate economic rules of the past to plan systems of the future. Prior trends will be reviewed here, as well as recent developments, to get an idea of where the computer world is headed.

Economics of the past. Until the early 1970s, computer economics appeared to be relatively simple. Computers were viewed as belonging to a single machine category for which the cost of hardware (usually its monthly rental charge) bore some direct relationship to the size or power of the equipment.

In the 1940s, Herbert A. Grosch stated that the cost of a computer system is directly proportional to the square root of the effectiveness of the system, in which effectiveness is some measure of performance, speed or throughput.

Researchers set out to determine the validity of Grosch's Law. One showed that there were economies of scale in the relationships between price and power of computer equipment, although the parameters of the relationship and its form were not as stated in the Law. Research also showed that technological progress caused drastic reductions, over time, in the per-unit cost of power.

Ten years later, three others questioned Grosch's Law and the subsequent empirical analysis. They asserted that such relationships were meaningless because the measures of price/performance that had been used did not provide for differences in computer markets—such as the distinction between large

general-purpose systems and smaller business systems.

One researcher claimed that the definition of computer power no longer applied to the architecture of the 1970s because of virtual memory and the trend away from tape to disk storage. The conclusion was that, for general-purpose computer systems, memory was a good predictor of system cost. A stable relationship existed between price and performance, with performance and memory capacity highly related.

For small business computers, essentially minicomputers, a stable relationship was not found for price/performance. The analysis showed, however, that minicomputer systems cost significantly less than the equivalent general-purpose configuration, perhaps because minicomputers had more specific application and did not have the same range of software, documentation and other features.

These conclusions contradicted the claim of earlier researchers that economies of scale applied for all computers. It demonstrated that smaller systems tended to have a price advantage over larger general-purpose systems. Other studies, however, indicated that advances in technology, over time, resulted in lower prices for both mainframe and minicomputer markets.

In 1978-79 some researchers were looking back at a general-purpose computer market that had stabilized by the 1970s and a small-business computer market that had not yet become stable. The market for personal computers was just being established. Although the word processing and personal computer markets had experienced rapid growth, they were still too small for serious analysis. Even as late as 1983, researchers had not fully recognized the rise of microcomputing.

Volatile marketplace. Now, in the mid-1980s, we are witnessing explosive growth in microcomputer-based workstations and personal computers, both for office and home use. In an atmosphere of competitive pressure, the home computer market is characterized by precipitously falling prices.

Such a volatile marketplace is bound to send tremors through the more established minicomputer and mainframe markets, but it is too early to determine these effects or to establish price/performance models for the new categories of equipment.

Sometimes a product is introduced, such as IBM's 4300 in the late 1970s, that contributes to significant upheaval in the marketplace for that type of equipment. Its price/performance falls below the break-even price of competitive products. In other cases, competition and technological advance bring one type of product into conflict with another. This is happening with superminicomputers and small mainframes, supermicrocomputers and low-end minicomputers, personal computers (PCs) with sophisticated word-processing software and word processors, and microcomputers and intelligent terminals.

The boundaries between products begin to blur, and predictions for growth veer from actuality as substitutions between categories raise havoc with expectations.

Where are we? What happened in the past five years to upturn the predictions of the late 1970s? The pattern that emerges provides clues to the unanticipated rise of the microcomputer and the relative lessening of the importance of minicomputers and mainframes.

The three major categories of computers—mainframe, minicomputer and microcomputer—differ for the most part by orders of magnitude. Mainframes and their peripheral devices typically cost millions, if not tens of millions of dollars for each configuration. A minicomputer configuration represents a tenth or less of that cost. Microcomputers are a tenth the price of minicomputers. There is also overlap between categories such as superminicomputers which cost the same as, or more than, small mainframes. But in general, the differences are marked between categories of equipment.

On the other hand, because the typical number of users supported by each type of system also bears the same order-of-magnitude relationship, the system cost per user is roughly the same. This was emphasized in a recent article showing the drop in cost per workstation for a shared mainframe remains competitive with the cost of a microcomputer installation. Many writers, however, predict the demise of mainframe computers and their replacement by mini- and microcomputers over the next decade.

Perhaps the most telling aspect in the rise of microcomputers, as well as minicomputers before them, is that lower hardware costs were accompanied by proportionately lower software, operational and support personnel costs. Microcomputers would have remained an engineering curiosity if their software and support were priced at the same level as for mainframes. Perhaps the main reason futurists and planners did not anticipate the rapid rise in PC sales was because of the unexpected availability of low-cost software packages and the development of equipment that could be easily operated by novices.

The drop in hardware and software costs for word processors and personal computers was possible because of the huge number of units produced. The production cost for additional copies of software packages is negligible compared to the cost of developing the initial product. The economies of scale that apply to computers are related primarily to hardware, and not to overall operations.

Where are we going? The glib answer is: "Not where we expect!" Earlier predictions have been, for the most part, wildly off the mark. Two things are certain, however: the cost of electronic circuitry continues to fall year after year,

Predicted Growth in Annual US Shipments

Equipment Category	1982 Shipments $BN.	%	1987 Shipments $BN.	%	5-Year Increase, %	Approx. 1-Year Increase	Start Period of Significant Sales
Mainframe (General-purpose computer)	11.9	42.5	15.2	26.2	28	5	Early 1960s
Small Business Computer	1.8	6.4	2.9	5.0	61	10	Mid-1970s
Terminal	3.5	12.5	5.8	10.0	66	11	Late 1960s
Mini-computer	3.9	13.8	7.6	13.3	95	14	Late 1960s
Word Processor	2.2	7.9	4.3	7.4	95	14	Late 1970s
Super-mini-computer	0.8	3.0	2.6	4.7	250	29	Early 1980s
Personal Computer	3.9	13.9	19.4	33.4	397	38	Late 1970s
TOTAL	28.0	100.0	58.0	100.0	107	16	

Source: Data in this chart supplied by International Data Corp.

New Economics of Computers

and the market for computers and computer-related products continues to soar.

It is clear that the developments of the recent past—resulting in the proliferation of remote workstations operated by non-data-processing (DP) personnel—will greatly alter the economies of hardware/software/personnel. This makes it almost impossible to measure the personnel component in particular because the primary function of individuals who program and operate microcomputers increasingly will not be DP.

The table in this article shows the major equipment categories for US products in 1982, and predictions for 1987. The categories have been ranked according to increases in annual shipments. The one-year increase is a percentage that, with annual compounding, leads to the five-year increase.

Two patterns appear in the predicted growth figures. First and foremost, there seems to be a strong relationship between the percentage increase in shipments and the period during which the product became well-established. Products introduced prior to the mid-1970s generally show much smaller increases in shipments than products introduced within the past five years. As products mature and their markets become saturated, their potential for growth is reduced.

Secondly, over the 1982-1987 period, the share of total shipments for old-line products falls from three-quarters of the total to about half. Although all categories of equipment are growing steadily, the differences in growth rates—if sustained—will lead to major changes in the breakdown of equipment markets by 1987.

The chances that the patterns presented in the table will eventually occur are remote. Two trends point to a slowdown of the growth rate in the superminicomputer and microcomputer markets.

First, we saw downward revision in the sales estimates for home computers—in one case, from seven million to five million units in 1983. Secondly, IBM introduced a series of general-purpose mainframe computers that compete directly with the superminicomputers. These developments suggest that some growth anticipated for the superminicomputers will fall to the equivalent general-purpose machines, and that the microcomputer market may be showing its first signs of saturation.

I would estimate that the total dollar volume of shipments predicted in the table will be realized in 1987, but that percentages will lean toward the general-purpose mainframes and small business computers.

The flaw in computer market forecasts arises because fully half of the projected 1987 market consists of products that did not exist five years ago. It is fair to state that many of the products and services (possibly 50 percent or more) that will comprise the computer marketplace 10 years from now either do not exist or play a very minor role in today's market. Consequently, the pure projection of current trends is not a satisfactory model.

The demand for computing. Basically there are two types of demand for computer services. One is the demand for existing services; the other is a latent demand for services that are not yet available at any price.

The demand for existing services has been shown to be price elastic. As the price/performance of computers has improved, total demand has increased proportionately.

IBM, for example, introduced a desktop computer, the 5100, almost a decade ago for about $20,000. It had minimal market acceptance. The IBM PC, introduced two or more years ago for about $3,000, has been a runaway success, partly because of its greater cost-effectiveness and the availability of low-cost peripherals. Easy-to-use versatile software has been another factor in its success.

'Computer power is not a good basis for categorizing computer resources.'

The demand for existing and potential computer services is changing over time as developed economies move from industrial to information (or service) sectors. That demand translates into the acquisition and operation of systems. The user demand is affected by an allocation system that matches demand to the available supply of resources such as mainframes, microcomputers and calculators.

The allocation process depends upon the value of the work to be done (which varies with turnaround time, response time, development time and probable distributions of these times) and the cost in providing these services.

The supply side. The key to the supply side of computer resources can be seen in the major equipment categories which differed in price by an order of magnitude. As mentioned earlier, however, categories sometimes overlap. The most sophisticated calculator costs more than the cheapest home computer. Small mainframes may be virtually equivalent in power to superminicomputers and cost about the same.

Technological advances continue, making for increased power and improved price/performance within each category. To quote the president of Texas Instruments, J. Fred Bucy: "As the cost of computing gets cheaper, it is likely that the more powerful desktop computers will start moving through marketing channels developed by the company's consumer group." This means that in a few years the home computer, while still priced in the hundreds of dollars, will have the capacity and features of today's personal computer which costs thousands of dollars, and so on up the line.

It would seem, then, that computer power is not a good basis for categorizing computer resources. By looking at price and the cost of support and software, the size of organizations that can acquire the equipment can be determined.

In addition to this vertical categorization of computer resources, a horizontal spread extends to data communications, process control, robotics, artificial intelligence and so on. These aspects of computing can be considered extensions to the commercial and scientific data processing functions. As price/performance of circuitry improves, extensions of processor technology become feasible.

The economics of computers prior to the mid-1970s no longer holds. The computer revolution has brought about societal changes that are moving us from an industrial to an informational world. This trend is creating new demands for computing.

Technology is advancing quickly to provide price/performance characteristics that enable products to be offered over an almost continuous range. With high-end processors becoming more and more powerful, increased power trickles down through all the smaller categories of equipment. As the market expands, the high cost of software development can be spread over more units. This creates additional demand because cheap software increases the value of equipment.

The new economics of computers can be explained in terms of the present and even used to anticipate short-term trends. But the acceleration in innovation makes it almost impossible to predict the marketplace of the future. (IN)

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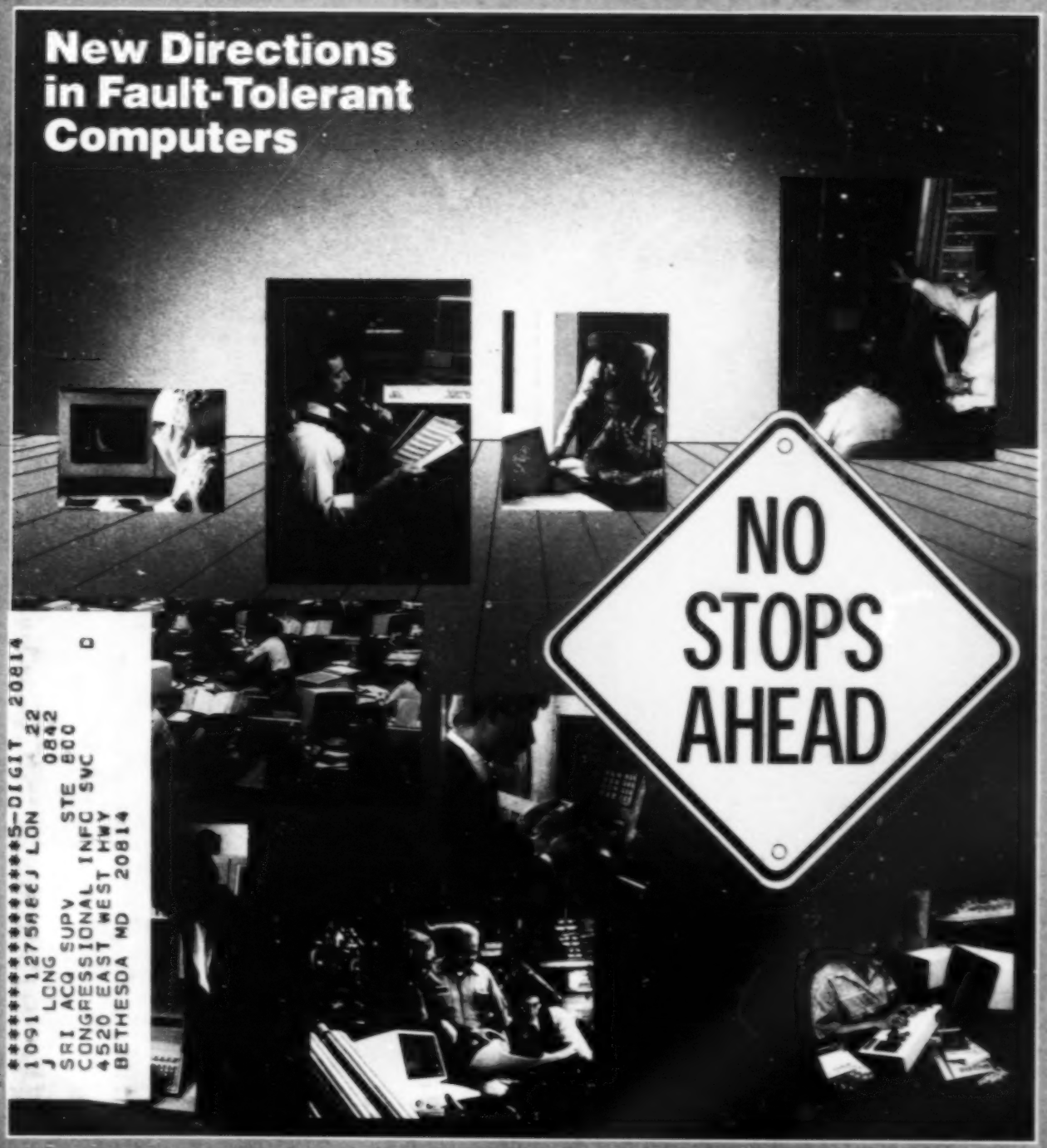

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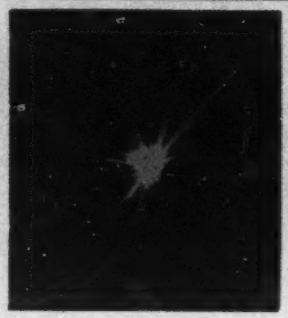
72

106

52

FEATURES

32
Inforum: **Dividing the IS Pie**

36
For the Sake of Security: **Choosing Encryption: DES or Private Key?**

40
New Directions in Fault-Tolerant Computers
Uptime isn't everything. But if you have a choice . . .

48
Interview:
The Art of Computerization

52
Critical Success Factors: Helping IS Managers Pinpoint Information Needs
Providing quality information to managers can be the key to meeting organizational goals.

56
Snyders on Software:
Addressing Special Needs

58
Moving Data Entry Out to the Users
On-line, distributed systems can cut data-entry costs and improve customer service.

62
Automating a Bureaucracy
A pilot program designed to boost Canada's computer industry yields valuable experience for participating government agencies.

68
Micro Business:
Timesavers in the Branch

72
Semiannual Software Review:
Maximizing Mini Resources

103
Manufacturing Info:
Cheap Labor Is Not the Secret

106
Fighting the Plague of Power Problems
With the UPS technology available today, MIS can outlast outages.

126
The Diebold Report:
Shaping a New Role for IS

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INSIDE INFO

21 Distributing IS functions: centralization versus decentralization
22 IBM finally discovers software world, but has yet to prove itself
25 Integrating voice with data may not require new terminal
26 Establishing policies is key to displacing paper in the courts

DEPARTMENTS

8 Feedback
12 Editor's Perspective
16 IN Brief
28 Arnie
116 Products/Services Info
120 New Micro Products
122 Literature
124 Plan Ahead
124 Bookcase
125 Ad Index

Automating

"We found that it was necessary to introduce technology on a deliberate phased basis," he says. "To implement a new technology when there is everday work to be done is a difficult task."

At Customs & Excise, Bell Northern Research designed a voice/data-oriented system. Two digital PBX switches, one in Toronto and one in Ottawa, supported 100 workstations split almost evenly between the two offices. Managers received Displayphones while knowledge workers were given VT-100 terminals with a phone featuring an auxiliary data module.

While Commins was pleased with the overall results of the trial and plans to expand the concept to include other regional offices, he does not believe office automation technology can be maximized until more research is available.

"There are a lot of good systems out there but I don't think we really know how to use them yet," Commins explains. "The problem is that we really don't understand the basics of the work process. We think we understand work but we really don't."

Commins thinks this is particularly true of managers. "Direct use of office automation by management will be limited because most managers do not make decisions on hard data. Most of that analysis happens at lower levels," he theorizes. "Managers make decisions based on what I call 'soft information' which includes factors like the advice of peers and colleagues. But managers will benefit from improved information flow." (N)

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A 'Rising Star' Instills Boredom

After catapulting to prominence in elite management circles, the rising young star's reputation began to lose some of its luster. The reasons were vague: inability to adjust to the demands of new surroundings, failure to perform up to expectations, and worse yet, eliciting boredom from top management. The result: demotion back to a more clerical position.

The preceding scenario is not that of an ill-fated, ladder-climbing young executive. It is the story of the rise and apparent decline of the desktop computer within corporate management.

While some analysts had hinted that management's love affair with desktop computers would not be an enduring relationship, a survey by The Omni Group is one of the first studies to provide statistical support. Among the survey's conclusions is that in more than 60 percent of Fortune 1000 companies, managers have begun to delegate computer-oriented tasks to support staff.

Sponsored by 13 computer-related firms, including a number of industry heavyweights, *TechTrends '85: Inside the American Office* was designed to investigate "undercurrents of change with respect to the impact of office technologies on white-collar workers," according to David Cushing, associate director of research at the New York City-based information technology research and consulting firm. The results were based on more than 3,000 interviews with computer users, planners and purchasers throughout US business.

"The TechTrends findings suggest that managers and professionals who use computers are getting tired of inputting numeric data," says Director of Research Dr. Warren Waldbrand. "Personal computing tends to glamorize clerical work, and managers have begun to realize it."

Financial applications are the most frequently delegated tasks. "Although managers value the results of office computing, such as the bottom line of a spreadsheet, they often consider computer use to be boring," explains Cushing. "In fact more than one-third of managers and executives surveyed cited 'boredom' as a critical problem associated with computer use."

This problem is compounded by the feeling of many managers that maintaining proficiency on office computers requires too much time. As a result, Waldbrand sees a "lingering frustration among managers who use office computers. To regain growth curves of the past few years, computer vendors need to address this problem."

While many managers may be finding that their desktop computers are not living up to original expectations, others never allowed themselves room for disappointment. They were simply never convinced that they needed a desktop computer in the first place.

Of nonuser managers surveyed, almost half expressed doubt that using an office computer would raise their productivity. Almost one-fifth did not believe computers were even appropriate for their job.

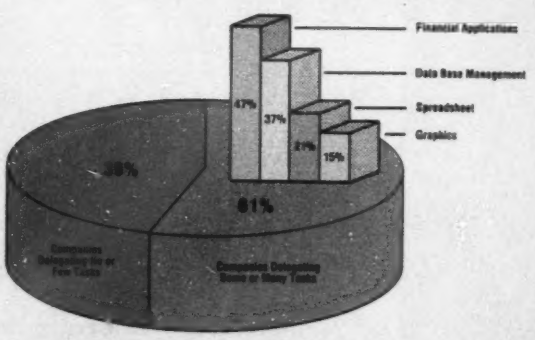
"Although computer use among executives and managers has mushroomed in the last several years, a large portion of potential users remain unconvinced of computer benefits," says Waldbrand. "This lingering mistrust of computers helps explain the recent wave of less-than-positive financial reports from some of the nation's leading computer companies."

The market slowdown in office computers is also linked to management information systems/data processing (MIS/DP) increasing control over office system purchasing. According to the survey, MIS now controls purchasing of office systems in 57 percent of Fortune 1000 companies and personal computer software in 74 percent.

"With major new responsibilities for strategic purchasing, MIS/DP departments have put the brakes on uncontrolled computer buying in the office," theorizes Waldbrand. "They are most familiar with the large computer systems, and we think many MIS groups still focus their efforts there rather than on the office."

Cushing believes this may change as office computers become seen as integral components of larger systems controlled by MIS. The key to this integration is local area networks (LANs). Almost half of Fortune 1000 companies surveyed have installed LANs among at least a portion of their computer users. By next year, the study predicts, more than 80 percent will have LANs, even if only on a small, pilot-project basis. PBX-based communications also are expected to expand rapidly. (N)

Delegation of Professional/ Managerial Tasks to Support Staff in Largest Service and Industrial Companies



Source: The Omni Group